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EDITORIAL NOTES.

The Chemical Clause—A Public Inquiry Necessary.

THE cumulative effect of the imposition of the chemical clause in Gas Acts this session will be to do the gas industry and the gas consumers of the country grievous wrong; and yet the gas industry as a whole has not had an opportunity of putting its case before the Parliamentary Committees who have created the precedents in this matter, owing to the restrictions that have been set upon evidence. This is a point that we wish the representatives of the gas industry and the Parliamentary Authorities to have embedded in their minds, in order to claim their serious attention for what follows. We have now arrived at a situation in which the gas industry has a right to appeal to Parliament on this matter of vital importance to it as an industry, quite apart from the consideration of the question in relation to isolated individual undertakings, which is the only consideration, we submit with all respect, that the Parliamentary Authorities have given to the subject up to the present time. For this assertion we take our stand on what has transpired in connection with the Swansea and West Kent Orders Confirmation Bill, which was before Lord Clinton's Committee in the House of Lords on Monday of last week. The short note on the matter that appeared in our succeeding issue was written with only the general information before us as to the course of the proceedings and as to the result. Since then there has been an opportunity of considering the complete evidence, and the position it creates. The result is that we are more than amazed at the decision of the Committee, as we think our readers will be on a perusal of the report that appears in our "Parliamentary Intelligence" to-day.

It will suffice if we confine our argument entirely to what transpired in connection with the Swansea Order, as it points both the unfairness to that Company, and the potential effects of the step-by-step control that the Parliamentary Authorities are giving to the chemical manufacturers of the markets for raw residual products, by not dealing with the question as one of policy affecting the gas industry as a whole, and the immense proportion of the community represented by the gas consumers. The exceptional circumstances of Swansea, in connection with their Order, are these: They were in Parliament last year for the purpose of obtaining manufacturing powers over certain land which they have held for several years with a view to works' extension. The application for these powers was opposed by the Corporation, who desired the Company to construct new works farther away. The Company acquiesced, and have since found a new site, and now merely asked Parliament, in effect, by this Order, to be allowed to exercise, in respect of the new site, similar powers to those conferred upon them last year for the land adjoining the present works. That is all. The power to manufacture and deal in residuals has been held by the Company for several years. That power was renewed last year, and would have been again this year, but for the intervention of the chemical manufacturers at the eleventh hour. It was, as a matter of fact, renewed only a few weeks ago by the Unopposed Bills Committee of the House of Commons, who were apparently convinced that the situation of the Company in relation to several small immediate gas undertakings constituted a reason, in the interests of those undertakings and the districts they serve, why the Swansea Company should not be debarred from purchasing, if and when necessary, residual products from them. Lord Clinton's Committee, however, have over-ruled this decision, and have imposed the chemical clause, though the Company have purchased residuals from these small companies, or some of them, and would in all probability have done so again had the prohibition not been thrust upon them. With this market for their secondary products closed to them, the small undertakings will feel more than ever how essential it was that it should have been kept open, as now they are denied the counteractive power and protection of this alternative market in ensuring that the prices offered to them by the chemical manufacturers are upon a fair scale. The Swansea Gas Company have themselves been robbed of a statutory right that assisted, or might assist, to balance prices, and which kept the chemical manufacturers from acquiring and exercising the power of a purchasing monopoly, which purchasing monopoly is now, by piecemeal legislation, being applied to the entire gas industry. That is the serious position.

This brings us to the case upon which we base the necessity for a general inquiry into the whole matter by some tribunal of independent constitution. It is quite obvious from what has transpired, in individual cases in one House or the other, that the gas industry (*quâ* industry) will not prevent a purchase monopoly of raw residuals, and consequently the ruling of raw residuals prices, falling eventually and completely into the hands of the chemical manufacturers, by fighting along the present lines. Let us examine this. The fact that the Swansea and West Kent Orders Confirmation Bill was not opposed by them in the first House, the fact that the Birmingham Corporation Bill and the Salford Corporation Order were not opposed in the first House, show conclusively that originally the Alkali Manufacturers' Association had no intention of asking for the insertion of the restricting clause in all cases. But the facility with which they have been able to create precedents, and the expanding view that this gave them of ultimately becoming the sole market in which gas undertakings not working up their residuals could dispose of them, encouraged them to prosecute their demands with increased vigour. When we speak of the "working-up of "residuals" let us explain to the Parliamentary Authorities that the gas industry generally has no intention, nor ever had, of going into the manufacture of chemicals beyond the maximum of what is now done, and has been done for years, by many ordinary gas concerns, which word "ordinary," of course, excludes those of exceptional size. However, when the attack commenced, the matter was not viewed from the industrial and public standpoints, but merely from the narrow geographical and individual standpoint. When, however, the objective of the chemical manufacturers became clear, then the new and wider aspects of the matter were found to be of industrial consequence; and the gas industry set itself to devise the best means of combating the attack upon its and the public interests. The decision of the gas industry was that the matter was one which ought to be discussed again before Parliament from a broader point of view than one applying to any individual undertaking. The Swansea and the West Kent Orders were considered good cases upon which to fully lay before Parliament the position from the gas industry's standpoint.

But what immediately happens? Here the gas industry finds itself defeated, by coming up against a sheer wall of presumption by a Select Committee of the House of Lords that the industrial question is settled by the precedents already created in individual cases. Lord Clinton, in effect, merely said: "All we are going to allow you to do is to attempt to "differentiate Swansea from the cases in which the clause "has been imposed." Right from the outset, his Lordship took this rigid attitude. "Is there anything," he asked almost at the very beginning of the proceedings, "different "in this case from other cases that have been decided this "session?" There was; and a statement by Mr. Balfour Browne, K.C., and the evidence of Mr. George Andrews and other witnesses as to the history of the Company and their geographical position in relation to other Companies, showed it. The determined limitation to contrast only with precedent cases was further shown at several stages. Upon this, too, there was the refusal of the Committee to hear any evidence that illustrated specific cases of hardship as to low values where there was not competition with chemical

manufacturers; that brought into relief the indications that the combination of the latter enabled them to offer and pay low prices for raw residuals; or that gave confirmation to the plea that evil would arise to small companies clustering about the larger ones by being deprived of the present markets supplied by their neighbours. As Mr. Shadbolt deposed in his evidence, there are some 61 gas undertakings to-day lending a helping hand to their neighbours. All such evidence, however, was ruled out; and the effort to bring it forward, in the interests of the gas industry, was finally knocked on the head when Mr. A. F. Phillips was called—Counsel being flatly told that it was no use calling him as a witness if he could not tell the Committee anything about Swansea. We need not say more to show that the interests of the gas industry as an industry have not been studied at all in this matter, nor the future effect of the new prohibition upon the prices of the raw residual materials of the industry.

However, we have reached the position where precedent governs Committees, and not the larger considerations for which attention is claimed. It was never intended, when this move of the chemical manufacturers was first made, that precedent should control all cases. The gas industry has been misled by parliamentary statement throughout the piece. Sir Harry Samuel's Committee, when dealing with the Annfield Plain and the Fleetwood Bills, said plainly they did not wish the clause to be regarded as a precedent; they did not desire the clause to be binding on all gas companies in the future. The Chairman of the Unopposed Bills Committee in the Commons stated that he should not insert the clause where it was resisted by companies; and, in the cases of the Swansea and West Kent Orders, this Committee came to the conclusion that they were ones in which the insertion of the clause would be detrimental. And yet Lord Clinton's Committee have reversed this decision. They declined to treat the matter on the broad basis, and to consider the question apart from precedent. Precedent was forced down the throats of the promoters from beginning to end. The chemical manufacturers are naturally very jubilant. They do not even trouble now to call witnesses. And when we consider how much was made of precedent during the Swansea proceedings, it is difficult indeed for anyone to understand the statement of Lord Clinton that, "while we do not regard the decisions which have been given "on certain other Bills of a similar character which have been "before Parliament this session as necessarily governing "all cases which may come up, yet we think that the pro- "moters have failed to show such an essential difference "between this case and those others that the precedent "should not apply." Then, too, why words of sympathy with the promoters when it was within the province of a Committee dealing with the matter in a broad spirit to show their sympathy in a more material sense by rejecting the claim that they should slavishly follow precedent in this matter in an Order merely referring to a change of works' site? "I must say," said Lord Clinton, "that I sympathize "with the promoters, in this respect, that they have come "here for something totally different, and are finding a new "Order thrust upon them." Mr. Balfour Browne: "You "are taking away power that we got last year, my Lords." Lord Clinton: "We are taking away power that you have "already; and I have some sympathy with you."

The evidence is complete that the matter is not being dealt with upon merits, that it is not being dealt with from the point of view of public interests, nor from the point of view of the maintenance of open markets and the prevention of a monopoly of the purchase of the raw residuals in favour of the chemical trade, with the consequent regulation of prices by that trade to their own benefit. The Committees, it is plain, feel themselves absolutely precedent bound; and it is quite hopeless for gas undertakings to proceed with the limited inquiry, and under the impatience of Committees, as experienced in this Swansea case. It is high time for the gas industry as an industry to seriously call the attention of the Parliamentary Authorities to the matter; it is incumbent upon the industry to do this, and to ask that the whole question may form the subject of some kind of public inquiry—the sooner the better—in order that it may be considered and adjudicated upon in its broadest bearings from the industrial point of view, and in a more statesmanlike manner than hitherto. As we have already said, the case in its widest aspects in relation to the industry has not been properly laid before Parliament, and yet the whole industry is being affected by this progressive application of the restrictive clause, which, in the aggregate of its imposition, will do untold harm. It is too much to expect the gas industry to take quietly such a position as the one that is being created; and the gas industry as such has a right to be heard in the matter. It is only through a general inquiry that the case can be properly handled and presented. The industry has had two interviews with the Lord Chairman, at the second of which the Chairman of Ways and Means of the House of Commons was present. For these interviews, the industry are grateful; and the gratitude would be intensified if the Lord Chairman and the Chairman of Ways and Means (both of whom, if it would not be considered presumptuous for us to say so, appear personally anxious to take a broad and statesmanlike view of the matter) would facilitate the appointment of some tribunal who could hear the whole case, and not merely a case fenced in by locality and precedent.

A severe blow has been dealt at the residuals markets of the gas industry by a powerful combination, with considerable money powers behind the members, who are (we have only to look at their present profits to see this) well capable of defending themselves in perfectly open markets. The gas industry must energetically meet the position, by organizing itself, and by bringing pressure to bear on Parliament to grant a full inquiry by a perfectly untrammelled and disinterested tribunal—a tribunal free from the precedents created without the whole public and industrial considerations being weighed.

Coal Contracts.

Generally speaking the gas-coal contracting season is late this year, on account of the coal strike, and the amount of coal that had, under the existing contracts, to be delivered following the strike. But the delay in making the new contracts does not appear to be working well for buyers in the matter of an easy settlement—at any rate, a combination of circumstances seems to be giving them some trouble in shaking the coal owners from a present fairly firm resolve to get round about 3s. per ton rise on last year's prices. Some works are even now short of deliveries on their old contracts; but this we think is due more to transit than to anything else, as the coal outputs generally are reported to be large. However, there is no doubt now that those works which made contracts early this year for the major part of their requirements for 1912-13 obtained a substantial advantage, as several contracts were heard of that were entered into at about, and even less than, one-half of the advance the coal owners are now asking. Negotiations are at the present time pending for large contracts; and the owners, as already said, are quoting rates 3s., and in some cases even more, in excess of last year's figures. They are referring to the Minimum Wages Act as the main excuse for this considerable increase. But this alone, having regard to the minima fixed by the District Boards, is somewhat preposterous.

The fact of the matter is that events have created a demand for this period of the year that is abnormal, and temporary; and the owners are using the strength that the position gives them in making their high demand for the long contracts. This is really unjustifiable. The position is entirely built up by the effects of the strike. The late completion of contracts, owing to the long cessation of work by the miners, has absorbed a considerable proportion of the output since that unhappy occurrence. Then large users in all industries, with the lessons of the strike before them, are increasing stocks; and this again, contributes to the making of purchasing heavier for this period of the year. As the settlement, too, of long contracts cannot be much longer delayed, and some of them are weightier than customary with the view to stocking, this gives advantage to the coal owners in making their demands. The extra price named in some quarters, however, is causing buyers to make inquiry at sources of supply other than those at which they customarily deal; and we can see, as a result of this, some sharp competition that may cause present ideas of price to shrink to get hold of profitable contracts. The coal owners are as well aware as the gas industry that coals producing a high illuminating power gas are not now so essential as they were at one time, and that the heavier retort charges now used produce a more compact coke from some varieties of coal than was the case in the days of lighter charges. Therefore the field of choice is widened, when financial considerations come seriously into play as a determining factor.

The Ilkeston Holder and the Factor of Safety.

SUPPLEMENTARY evidence has been heard by Mr. A. G. Drury, M.Inst.C.E., on behalf of the Home Office, in relation to the inquiry into the "causes and circumstances" of the Ilkeston gasholder disaster; the principal contributor to the additional testimony being Mr. W. Doig Gibb, the Chief Engineer of the South Metropolitan Gas Company, who was called as a witness by the Home Office. Mr. Gibb has had wide experience in the construction of holders, among them being one that stood as the largest spiral-guided structure at the time of its erection, and the exposed situation of which made highly essential a very close and careful study of the stresses, strains, and other factors appertaining to stability under the severest of conditions. The supplementary evidence is a matter of extreme interest to all concerned in the design and construction of gasholders, in that it has produced fresh information concerning the tank-plates, and further confirmation of the point that there has been a tendency to a too narrow factor of safety. At the previous inquiry, the evidence went to show that the factor of safety was above the theoretical requirement, but not up to the 4 that the independent engineers who had given evidence suggested would be preferable in the case of above-ground steel tanks for spiral-guided holders. In these tanks, a more generous margin will in future have to be allowed than is found in some of the more recent constructions.

Mr. R. J. Milbourne quoted safety factors of 3·1, 3·7, and 3·8, and 4, as being represented in modern built gasholder tanks. These illustrate the wide variations that exist in the views of not only contractors but engineers on this point—in fact, one of the lowest factors of safety for the tank of a spiral-guided holder was, Mr. Milbourne pointed out, approved by a leading engineer. Competition is blamed by him for having had a great deal to do with the reduction of the margin of safety; and a stop must be put to this. We know gasholder contractors sufficiently well to believe that, after this Ilkeston disaster, they will take the advice of Mr. Doig Gibb, and retrace their steps in the matter of the margin of safety for above-ground tanks. There will be no difficulty in inducing gas undertakings to pay the extra for the additional safety; for, if competition is the cause of a narrow margin of safety, that is what it comes to. Mr. Milbourne considers that 3·5 is as low a factor as they ought to adopt. Mr. Gibb, Mr. J. Ferguson Bell, Mr. Samuel Glover, and other engineers, speaking from the side of those who have to pay for and use holders, and take the responsibility for them, all prefer a factor of safety of at least 4. Mr. Gibb, in fact, wants more than this for spiral-guided holder tanks above ground. But in prescribing any figure, there is a responsibility on the part of the undertaking to see that it is obtained in the different parts; and this is a matter for the expert, and not for anyone whose gasholder constructional experience has merely been that of a more or less distant observer. For example, in the Ilkeston tank, Mr. Gibb calculates that just below the top curb the factor of safety was only 2·04. All the evidence points to the necessity for a revision of ideas as to the margin of safety for overground gasholder tanks.

There is one other matter. A new point has been made in showing that the phosphorus content of the plates in the tank stood at a percentage that pointed to brittleness, though there is a discrepancy between the figures advanced. Then again points on which there was all through more or less assumption are as to the sequence of events in the disaster, and as to whether the tank burst commenced at the top or the bottom. Mr. Gibb's deductions from the available evidence—evidence available to all—are opposed to those of engineers who preceded him in giving testimony. But he is no more dogmatic than they over the subject, though he disagrees with their conclusions. He believes, from the condition of the holder and the happenings as related by witnesses, that the initial trouble was the bursting of the tank, and that the first burst was at the bottom and not at the top. Then the distortion of the outer guides followed; the lifts came down not with a run, but with a rocking or jumping motion, which resulted in sparking and the ignition of the gas. This is contrary to any former theory that has been advanced. And who is to say from the meagreness of solid fact whose conclusions are right? The opposing views have certain, but not conclusive, support; and any one of them may be correct.

There is one thing that Mr. Gibb said he should like to add to his evidence; and it is right that his remark—fair and just in the particular circumstances—should have all possible prominence. He observed: "The Company I am associated with now have upon their list the name of the firm who made this particular holder. It is a firm which has a very high reputation; and nothing which I have seen of this holder tempts me to strike the firm off our list of reliable people."

Technical Matters at the Irish Meeting.

THE members of the Irish Association of Gas Managers had a good meeting in Dublin last Tuesday; and their's was the honour of a reception by the Lord Mayor—this courtesy and recognition being due, we believe, to the esteem and regard in which Mr. C. B. Outon, the President, is held in the city. As the Gas Engineer to the Great Southern and Western Railway, he has upon him the responsibility of the gas lighting and heating arrangements of the Company's large Inchicore works, as well as the lighting of the Company's stations and railway coaches. Up to the best modern standard is everything—from the high-pressure lighting of the works, and the heating arrangements there for the large parts of the locomotives, to the illumination of the railway carriages. Mr. Outon believes, and he is seconded heartily by those of ruling power in the Company, in having the best gas appliances—the appliances of highest efficiency—in every part of the Company's operations. Inverted burners are now being applied in the carriages; and 50-candle power units are generally used, with 25-candle power ones in corridors, lavatories, &c. The result of this is that the Inchicore works in Dublin are regarded as in the fore-rank of well-lighted railway works; and the incandescent gas-lighted carriages on the line are much appreciated by the public. No mishap has been recorded. The town-gas industry has something for which to thank gas men holding positions in which they can, while giving their own Company economy and a good character for lighting, keep the efficiency of gas methods well in the public eye. The varied use of coal gas by the Company is shown in Mr. Outon's address. They find its employment reliable and economical, among other things, in driving two 82 H.P. engines for generating electric current for crane driving.

Mr. Outon's varied experience, and the wide view he can consequently take, enable him to look upon the present technical advances in the utilization of gas with much gratification; and it is clear that to him the accomplishments of the past induce a fervent belief that the future has yet much in store in the way of increasing the value and the service to mankind of the gift of Nature for the distribution of which the gas industry is the vehicle. Those go farthest who know no limits. He, however, sees in some cases that there are gas undertakings which are not altogether faithful to their trust. Giving them all credit for their distance from the coast, he cannot justify, from his own knowledge, some of the prices charged for gas. This condition of things is suicidal; for high prices are an obstruction to a larger business in lighting and heating, and they are an invitation not only to electricity, but to petrol air gas, acetylene, and suction gas, to come in and worsen the conditions for the town-gas supply. Often combined with high prices are low salaries for the managers. The two things, unless the concern is exceptionally badly located, supply good testimony to the inefficiency of administration.

One word more about the interesting address. Mr. Outon refers to the question of the new mode of warfare of labour by creating national strikes—not only in the coal-fields, but on the railways and among transport workers—and its relation to coal stocks. He remarks that "our judgment," in this matter, "will be based upon the consideration of loss of interest on increased coal stocks as compared with the enhanced prices demanded during the recent shortage, and the extra delay involved by the exceptional demand for waggons and steamers to balance the former delay of deliveries." We do not think this is a matter that must be looked at entirely from the financial side. There are obligations to the consumers, there is reputation, there are the prospective effects of a breakdown in the gas supply due to the stoppage of coal deliveries to be considered—and, we say, to be considered before the question of the additional cost of two or three weeks' extra stock beyond what was at one time regarded to be a prudent normal.

There was some good technical fare for the meeting in addition to the presidential address; but though the papers

were ample and good, the discussions were not of a very brisk or informative order. The paper that Mr. T. Hornby read describing the modest sulphate of ammonia plant at Longford is one that is opportune, though the working results that are disclosed in the paper are not of the best. Substantial improvement, however, has been made on the first year's working; and further advance there will undoubtedly be when Mr. Hornby instals a lime-still, and so prevents the loss of ammonia that occurs at the present time. However, the main thing is that profit is made from the plant; and there is scope offering for the profit being higher still. If the present course continues in Parliament that is gradually bringing about a condition of things that will constitute the chemical manufacturers the sole purchasers of raw residual materials from small works, such works—works of a few million cubic feet sale—will more and more have to consider the propriety of working up their own ammoniacal liquor, or of a few neighbouring small works pooling their ammoniacal liquor, producing sulphate, and dividing the proceeds according to their liquor contribution. Under these circumstances, it will be interesting to hear as much as possible of the experiences of small gas-works engaged in this branch of productive work.

From sulphate of ammonia production, the members turned their attention to the subject of "High-Pressure "Lighting," which was treated upon in an excellent paper by Mr. Alex. M'I. Cleland, of Belfast, in which city there has been, in the industrial establishments, some good experi ence with this system of lighting, and to a smaller extent for street lighting, from which latter system parade lighting is going to push its arms with a great hopefulness of embracing much success. Mr. Cleland's paper is interesting for more reasons than one—dealing as he does with the theory of incandescent lighting, and giving many useful hints from experience, as well as actual working figures as to consumption, maintenance, mantle renewals, and costs, including compression costs by electricity, and lighting costs in comparison with electricity. There are, in dealing with the theory of incandescent lighting, one or two little points that might perhaps be altered or qualified. In one place Mr. Cleland says the "greater" the aëration of the burning mixture, the greater the heat of the flame. The quoted word, we think, should have been rendered "better" or "more complete," because, as a matter of fact, the less the quantity of air that it is necessary to introduce into a gas-flame, under given conditions of use, to secure complete combustion, the higher the flame temperature. Then among the constants, Mr. Cleland places an "unvarying supply of "air." That we should say ought to be qualified by the words "subject to any variation in the constitution of the "gas." However, those are merely small points that strike one on reading through the first part of the paper. Regarding costs, it is seen that those on which progress and experience can be brought to bear in producing a diminution have been reduced from those that obtained at the advent of this system of lighting in Belfast. This is a natural result in the hands of a capable supervisor of such work; and there is still room with progress for a further lowering of costs. The information in the paper is valuable; and the photographs illustrate both the merits of the high-pressure system and the excellence of the maintenance.

A paper that will attract those suffering from hydraulic main troubles was that contributed by Mr. J. F. Tyndall, of Wicklow. He relates an experience as to the breaking of his dip-pipe seals; and how he found this was due to heavy oscillation in the main, produced by back-pressure. The method he adopted for curing the trouble is not the least interesting part of the paper.

The final contribution was by Mr. P. J. Fitzpatrick, of Maryborough. In this he shows himself a distinct partizan of the upright as opposed to the inverted gas-burner, though recommending the latter to a large extent where he is of opinion that it will behave itself. At the same time, he has more fault to find with that type of burner than with the upright form. Speaking with considerable experience of the inverted burner in London and elsewhere, the conclusion we have arrived at is that there is no room for congratulation to Mr. Fitzpatrick on having discovered so many faults in the newer type of burner, which are not commonly disclosed in a much greater experience than can have been obtained in Maryborough. If things were as he represents, would Westminster and most of the gas-lighted boroughs north and south of the Thames have adopted inverted burners to the extent they have done for street purposes, with eminent success, and to the exclusion of the upright type? Perhaps Mr. Fitzpatrick's gas supply is constantly varying in composition, specific gravity, and pressure. If so, then much is explained.

Calorific Power in the United States.

THE letter by Dr. E. B. Rosa, of the Bureau of Standards in the Department of Commerce and Labour at Washington, published in last week's issue, came to hand as the "JOURNAL" was being prepared for press; and therefore we could not call particular attention to its contents at the time of publication. It is interesting to have the explanations of Dr. Rosa as to the advisory and the co-operative relations existing between the department and the gas interests. But this was not the point of our former brief and general comment on the interesting paper of which our correspondent was the author. It may be remembered that Dr. Rosa advocated that calorific determinations should be expressed in the net and not in the gross, and that, as a concession to the natural desire of the gas industry to keep the larger figure as to heating value in the eye of the public, the net calorific value should be determined, and an equivalent added to the net value to represent the gross. We really do not see the necessity for this. The question of net or gross values is a matter upon which something can be said on both sides. There are, however, substantial objections to standards and official tests being reduced to the net value; and the consensus of opinion in this country and in the United States (so we gather from a paper presented by Mr. J. B. Klumpp to the British Institution of Gas Engineers in 1910), is in favour of the gross. For reasons stated in their notification, the Metropolitan Gas Referees (Professor A. G. Vernon Harcourt, Dr. J. S. Haldane, and Professor C. V. Boys), as mentioned in the "JOURNAL" for Aug. 8 last year, p. 345, do not think the customary partial correction from gross to net has much significance. Other reasons for gross determinations being preferable to the net will be found succinctly stated in Mr. Jacques Abady's contribution to the discussion upon Mr. Klumpp's paper in 1910. There is no occasion to reiterate all the reasons derived from expert experience that have been opposed to the taking of the net value for standard or official purposes. Supplementing these reasons is a fact of some importance in this connection: There are no authorities perhaps who have had greater experience in daily calorimetric work than the officers in the gas-testing department of the London County Council; and though, in the first statutory standard applied in this country (that of the Gaslight and Coke Company), net value was stipulated, the two succeeding standards fixed in agreement with the London County Council (the Wandsworth and the South Suburban standards), the gross value has been taken, and has been endorsed by the Legislature. Of course, no one will suggest that in experimental work, the net value should be neglected.

Then it will be remembered that Dr. Rosa proposes, instead of calculations being made at 60° Fahr. and 30 in. bar., that the annual average local temperature and barometric pressure should, in making corrections, be taken in every district. We are strong believers in calculations being made to average standard conditions, and not be subject to atmospheric vagaries, and increased trouble from personal error. Dr. Rosa is evidently stung a little by our reference to his proposal to introduce new "complications." We looked at the matter from our home experience; and his suggestion appeared to us to be unnecessarily imposing fresh conditions, instead of maintaining standards with standard conditions attached. America is a large Continent; temperatures and barometric pressures may materially vary in parts distant one from the other. But we take it there is not sufficient variation, in either respect, in any one State as to render it necessary in that State to make correction to any other than standard conditions in regard to temperature and barometric pressure. There is no particular virtue in 60° Fahr. and 30 in. bar. Here we find the figures fair and useful; and they assist one experimenter in one part of the country to know precisely how his results stand in relation to those of another experimenter working elsewhere. Dr. Rosa refers in his letter to 27 and 25 inches barometric pressure. We take it that these figures were only employed for illustrative purposes, and that these pressures do not obtain as annual averages in many gas-supply districts, unless they are mountainous, and are fortunate enough to have gas supply at very high altitudes. If Dr. Rosa insists on his

local annual average temperature and barometric pressure, we suggest that it would be far better, in any one State, to have, for the sake of uniformity, a constant temperature and barometric pressure to which to correct, and then, should there be abnormal conditions, in regard to temperature and pressure, to make secondary special corrections. This would be one way of getting over Dr. Rosa's scruples in the matter of reducing to the constant condition of 60° Fahr. and 30 in. bar. on the ground that it gives "fictitious and misleading" values, which are neither "scientific nor honest."

Gas Preferred to Electricity for Public Lighting.

In another column will be found a short report of a discussion in the Doncaster Town Council last Thursday, the outcome of which was the adoption of a recommendation of a Special Lighting Committee to employ gas and not electricity for lighting the main streets of the borough. Readers of the "JOURNAL" may remember that experiments have lately been carried out by the Gas and Electricity Engineers (Messrs. Robert Watson and E. S. Rayner), with the view of assisting the Committee in coming to a decision as to which illuminant would be the more suitable for the purpose named; and it was after going very fully into the subject, and inspecting diagrams of light curves and other matters connected with it, prepared by both officials, that this decision was arrived at. The contest between the two departments was keen and exhaustive; and we trust it has not, as one member of the Council seemed to think it had, engendered ill-feeling. Why should it? Each department—or rather its representative official—did its best to get the job. The Electricity Department used Crompton Blondel arc lamps; and the Gas Department offered two systems—high pressure, and low-pressure high-power lamps (1000-candle units). The contest really took place between the latter and the arc lamps. The tests were, we understand, made jointly by the two engineers, with their respective assistants working with them; and, averaging all the tests, the gas-lamps showed the highest minima foot-candle values on the same price basis. Apart from this, gas scored generally from the point of view of distribution and diffusion. The Gas Department put forward a series of points in favour of gas for street lighting purposes; and the decision of the Council seems to show that the claims, which will be found after the report of the meeting, have been substantiated. It is interesting and gratifying to be in a position to record, in two succeeding issues of the "JOURNAL," triumphs for gas such as those achieved at Bournemouth and Doncaster.

Passing the Limits of Persuasion.

Reference was made last week to the campaign of the Employers' Parliamentary Council in the endeavour to secure such an amendment of the law that the evils of picketing may be suppressed and the right of freedom to work pass unchallenged. That such efforts are warranted, and in the best interests of all parties, will be conceded by the great majority of those who have followed events in connection with the present trouble with the transport workers in London. This dispute has presented such a condition of things that one is forced to the conclusion that "peaceful persuasion" is a term which is having bestowed upon it an unreasonably wide definition. But however difficult it may be, in the light of current happenings, to determine exactly what does constitute "peaceful persuasion," within the meaning of the Act, it is comforting to note that a Judge and Jury have just demonstrated to those whom it may concern that the limit falls short of actual violence. In connection with a strike at the Talk-o'-th'-Hill Colliery, near Stoke-on-Trent, Union pickets who intercepted two of the men who remained at work were indicted at the Staffordshire Assizes for unlawfully intimidating them, with a view to compelling them to abstain from working. The words which were admittedly used by someone (though the two prisoners being tried said it was not by them) were to the effect that if the men went to work a crowd would wait for them on their return and give them a "good mobbing." The leader of the pickets was not then charged; but he was a witness, and told the Court that the statement complained of was used, "but there was no intention of using violence." His evidence was very unfortunate—for himself—inasmuch as the Judge promptly ordered him to be taken into custody and charged before the Magistrates with intimidation. Subsequently, the two men before the Court were convicted by the Jury; two others meanwhile pleading guilty. In the case of three of them a sentence of four weeks' imprisonment was passed; while the fourth, who was regarded as a ringleader, received exemplary punishment in the shape of two months' hard labour. Passing sentence, Mr. Justice Phillimore remarked that some of them seemed to think there was no harm, in the time of a strike, in preventing other workmen, who wished to work, from following their employment. This prosecution had been undertaken to teach them that it was harmful, and was a crime punishable by the law of the land. Everybody had a right to strike; but if the prisoners did not wish to work, they must understand that they had no right to prevent others from doing so. His Lordship added that he had had a longer experience than the prisoners, and he would say that, "if there were such a right, England would soon fall to pieces, and everyone would be in poverty and distress." The object-lesson presented by this trial, and the remarks of Mr. Justice Phillimore, may well be kept in mind.

PERSONAL.

Mr. JOSEPH GEORGE CLARK, the Engineer and Manager of the Newton Abbot Gas Company (of which he is also a Director), celebrated his silver wedding last Saturday; having been married on July 13, 1887, at the Parish Church of Twerton-on-Avon, Bath, to Alice, third daughter of the late John Allen, of that place.

Mr. A. S. WADSWORTH, on his retirement from the position of Works Manager at the Wolstanton United Urban District Council Gas-Works, was the recipient of a very handsome marble timepiece, a gift from the office staff and employees at the works, as a token of their respect, and accompanied by their good wishes. The presentation was made by Mr. G. J. Mear, the Secretary, and suitably acknowledged by Mr. Wadsworth.

The workmen and staff at the Longton Gas-Works have made a present to Mr. T. J. NODEN, on leaving Longton to take up his new duties as Manager of the Whitchurch (Salop) Gas-Works. It consisted of a pair of handsome Bretby vases and a Bretby clock. In making the presentation, the Gas Engineer and General Manager (Mr. W. Langford) spoke in the highest terms of Mr. Noden's services, and emphasized the good feeling existing between the workmen and staff. He said they were sorry to lose Mr. Noden, and wished him every success in his new sphere of labour. Mr. Noden acknowledged the gifts in a few well-chosen words.

At the monthly meeting of the Burton-upon-Trent Town Council last Wednesday, the report presented by the Gas and Electricity Committee contained a recommendation that the salary of Mr. R. S. RAMSDEN, the Assistant Manager, should be increased by £25 per annum. The Chairman of the Committee (Alderman Lowe), in moving the adoption of the report, pointed out that, if the Council approved of the recommendation, they would be paying, inclusive of the retaining fee to the Consulting Engineer (Mr. J. Ferguson Bell), substantially less for the management of the gas-works than was paid in respect of similar undertakings elsewhere. Mr. Ramsden did his work exceedingly well; and he (Alderman Lowe) did not think the recommendation was unfair or unreasonable. The report was adopted.

The Tribute to an Inventor.

In the "JOURNAL" for April 30 (p. 280), we intimated to our readers that the friends of Mr. Stephen Holman, M.Inst.C.E., were subscribing to a fund for the purpose of presenting to him a life-size portrait in oils and an appreciative tribute in "coin of the realm." From a list prepared by Mr. Holman, we find that the following gas undertakings have subscribed: Gaslight and Coke Company, South Metropolitan Company, South Suburban Company, Brentford Company, Tottenham Company, Salford Corporation, Croydon Company, Newcastle-upon-Tyne Company, Brighton and Hove Company, Kingston-on-Thames Company, Hornsey Company, Douglas (I.o.M.) Company, Lea Bridge Company, Richmond Company, Southgate Company, North Middlesex Company, Southampton Company. Among the engineering firms who have also sent contributions are: West's Gas Improvement Company, Limited, Clapham Bros., Drakes Limited. In all, an amount of £115 5s. has been subscribed; and it has been arranged for the list to close within a month from this date. Any further contributions, therefore, should be promptly forwarded to the National Provincial Bank of England, 88, Cromwell Road, South Kensington; and additional names will be intimated in a subsequent number of the "JOURNAL."

The Young Memorial Lecture.—We learn from Mr. Samuel Milne, of Aberdeen, President of the North British Association of Gas Managers, that, owing to the condition of his health, Professor Smithells has been reluctantly compelled to cancel his engagement to deliver the Young Memorial Lecture at the meeting of the Association in September. Dr. Harold G. Colman, however, has consented to undertake the work.

NOTES FROM WESTMINSTER.

The Chemical Clause, and a Public Inquiry.

THERE is a special article in our editorial columns, suggesting that the time has now arrived when there should be a special public inquiry, in the interests of the public and of the gas industry, into the whole question of the imposition of the chemical clause upon gas undertakings. The matter has now resolved itself into one for the entire gas industry. As we have pointed out before, and point out again, the persistent insertion of this clause, or its equivalent, in Gas Bills and Orders will have the effect of bringing about a condition of things that will be baneful to the entire gas industry, and beneficial to the wealthy combination of chemical producers represented by the Alkali Manufacturers' Association. The gas industry has now to ask Parliament to look beyond the mere aspect of the matter as presented by its consideration in relation to any single gas undertaking. There is something more in it than this; and Parliament have not yet fully examined the matter in its broader aspects and in relation to the possible effects of the limitation. They may be asked to do so now; and to remove the inquiry from the Committee rooms where the industry has heard that cases are not to be treated as precedents, but where Committees are nevertheless precedent-bound, and will not listen to evidence affecting the matter in its larger aspects. We have, too, the spectacle of the chemical manufacturers coming along, requesting the insertion of the clause, and obtaining it, without any witnesses of their own being put into the box, and examined on matters which have come to light, and which are the portents of what the gas industry and the country may expect if the Parliamentary Authorities continue to place additional power in the hands of the chemical manufacturers by curbing the raw residuals purchasing power of gas undertakings. We have the spectacle, too, of the indulgence of Parliamentary Committees having increased the appetite of the chemical manufacturers. They ask for the insertion of the clause now in any and every Gas Bill or Order, no matter the size of the promoting Company—small or large, it is all the same. At the beginning of the session, they did not do so. There have been several Bills and Orders unopposed by them in the first House—generally the House of Commons; but when the Bills and Orders have reached the House of Lords, along have come the Association, and have obtained without trouble the insertion of the clause. They did not oppose the Salford Order in the Commons, just as they did not oppose the Birmingham Bill. But they are going to ask for the clause to be inserted in the Salford Order in the House of Lords; and they are no doubt as confident of getting it under the present circumstances as they were in the Birmingham case, in which they were not desired by the Committee to offer the slightest justification for its insertion. What has transpired in the House of Lords in connection with the Swansea and West Kent Orders is dealt with in our leading columns; but the evidence as reported in the "Parliamentary Intelligence" should also be perused. In Mr. R. G. Shadbolt's testimony will be found figures referring to the results of the circular of inquiry of the Council of the Institution of Gas Engineers.

Borrowing Powers by Local Bodies. The restriction that the Unopposed Bills Committee of the House of Commons last session placed upon the borrowing powers of the Milford Haven gas undertaking was based upon good reason. The power that is usually given to local authorities to borrow for trading undertakings by sanction of the Local Government Board enables these municipal bodies to refrain from coming periodically before Parliament for the revision of their existing powers, the same as statutory companies have to do. The same Committee have now placed a restriction upon the increase of capital desired by the Newcastle-under-Lyme Gas Department; the additional power being limited to £30,000. The Local Government Board naturally look upon this as a trespass upon their discretionary privileges; but the Parliamentary Authorities have a good notion of what the ability to apply to the Local Government Board means. It means unlimited powers; and a long absence from Westminster. But, argue the Board, "We hold an inquiry first, before granting extra money powers." To this the Parliamentary Authorities reply, "Your inquiry is not the same thing as an inquiry by a Parliamentary Committee." To which the Local Government Board answer, "We listen to everything that outside authorities and ratepayers have to say." The obvious reply is given, "True; but you have no power upon their representations to amend existing Acts of Parliament, on an application for extended capital powers." That is the difference. The Committee in the recent case of Newcastle-under-Lyme were generous. The £30,000 they gave is equal to the estimated capital requirements of twenty years. No Company in the present day is dealt with on such a liberal scale. The only complaint there is to be made of the Parliamentary Authorities in this regard is that they do not apply the limitation in all cases alike. It seems ridiculous to apply the limitation to gas and not to other municipal trading services; and so it does to apply it to an established gas undertaking, and yet allow a new municipal concern to obtain statutory powers on the old lines of unlimited capital by simply applying to the Local Government Board.

The Winchester Clause. Since the Cheltenham Gas Company appeared before Sir Francis Lowe's Committee asking for the insertion of the Winchester clause (with an extension to meet special requirements) in the Cheltenham Electric Lighting Order, we have been forced to meditate over the question as to what sort of evidence Sir Francis Lowe and his honourable colleagues really want to satisfy them upon a matter of this kind. The Winchester clause is the latest of its race in the direct line of descent from the Bermondsey clause. The Gas Company proved their right as ratepayers to be heard. They pay £2000 a year in rates, or one-twentieth part of the total sum collected in the borough. Sir Francis Lowe sapiently remarked that it was curious that in these cases it was the local Gas Company who always opposed as ratepayers. There is nothing at all that is singular about it. The Gas Company are often the largest ratepayers in a borough of this kind. Therefore their interests in such a case are the largest. Whatever the service for which the local authority have to pay, the Gas Company have to meet the largest proportion. Bearing this in mind, when a Gas Company know that the Corporation, in order to raise support for their electric lighting undertaking, are charging the ratepayers £30 per arc lamp for public lighting, with electricity at 3d. or a fraction under per unit, they have, as ratepayers, a legitimate right to ask that these prices shall be reduced to a more reasonable level. Cheltenham stands at about the top of the tree in the matter of charges for public electric lighting. If the Gas Company do not take up a matter of this kind, then the private ratepayers (whose individual interest is much smaller) are not likely to be prepared to meet the heavy expenses incurred in bringing the matter to the notice of Parliament. Electrical testimony was called to show that Cheltenham holds a matchless position in the height of its public lighting charges, and therefore that they are excessive. Despite this evidence, Sir Francis Lowe and his fellow legislators (instead of being obliged to the Gas Company for calling their attention to the matter) failed to see that the Company had proved their case for the insertion of the extended Winchester clause. We ask again, What stronger evidence could they have desired than the Gas Company offered, through Counsel, and Mr. James Paterson and other witnesses? Several instances could be quoted in which the Bermondsey and Northumberland clauses have been inserted on cases of less strength than the one put forward by the present petitioners. After the decision, however, it transpired that the Corporation had offered the Company the Winchester clause, but the Company did not consider the clause entirely covered the special points of the Cheltenham case; and therefore they were desirous of getting the Committee to strengthen the terms where it was considered they were weak as applying to Cheltenham. It did not seem to penetrate the minds of the Committee that the fact that the Corporation, in their wisdom, had considered the Winchester clause should be applied was a somewhat harsh criticism of the Committee's own judicial powers. On the other hand, the Committee took it that the Corporation having offered to insert the Winchester clause without the addition was a sufficient reason why the Company should pay the costs incurred by the Corporation through the opposition from the date of the offer. The Committee overlooked the fact that, under the circumstances, the whole fight was over the addition, and not over the Winchester clause; and to be fair they ought not to have ordered the Company to pay unless they gave them the Winchester clause without the addition. But there in these days, we do occasionally come across queer parliamentary decisions; and the decision of this Committee in this particular matter, having in view the evidence, is one of those which the qualitative term perfectly fits. The same Committee were considering on Thursday the Holmfirth Electricity Order, which the Gas Company were opposing, represented by Mr. A. M. Paddon. The matter was under further consideration yesterday; and reference to it may be deferred to next week.

Water Points. The Water Charges Bill of the Glasgow Corporation has been before the Earl of Kintore's Committee. The object of the promotion is to provide facilities to enable the extension of the water supply of the city for a population of 1,130,000. It is intended to lay two additional 36-inch mains for the transmission of water from Craigmaddie partly through land owned by the Corporation, and partly through the territory of other owners—principally railway companies. With these owners terms have been arranged. On learning these facts, the Committee passed the preamble of the Bill. The Sheffield Corporation have been held to have wrongfully appropriated from the water surplus account, and to have applied to the Rivelin Valley Road, the sum of £61,000. The Committee presided over by Sir Norval Helme have been considering, in dealing with the Corporation Bill, how best to adjust this wrong appropriation. The Chairman of the Finance Committee of the Corporation tried to get the Committee to allow them to repay the sum to the water surplus account from the revenue of the Water Department. The "cheek" (this seems to be a suitable word) of the proposal is great. The water surplus provided by the water consumers is robbed for a purpose to which the water surplus was not applicable; and when this is found out, and the money has to be replaced, the Corporation suggest that the water consumers should find the money with which to do this. Sir Norval's Committee could not see the wisdom, righteousness, or sanity of the suggestion; and therefore they have imposed upon the Corporation the duty of repaying the money by borrowing it, with a period for the repayment of the loan reduced to seventeen years from April 1 last. The Corporation will not forget April 1, and this correction of a piece of financial wrongdoing. A water clause in the Swansea Corporation Bill gave rise to some considerable

discussion before Mr. J. S. Fletcher's Committee. It has reference to the repair of water-communication pipes; the Corporation desiring power to promptly deal with leakages in order to stop waste. The Committee had some scruples about giving the Corporation power to enter people's houses without notice; but they agreed to a clause providing that, if possible, reasonable notice should be given. There has been an extensive fight over the East Surrey Water Company's Bill, before Lord Clinton's Committee. The Reigate Corporation and the Croydon Rural District Council put in an appearance with the object of obtaining a further reduction of charges; and opposition was also offered by the Croydon Town Council and the River Wandle Protection Association, who urged that powers to enable the Company to obtain the additional supply of water sought for from their Purley well should not be granted. The upshot of a long discussion was that the Committee limited the increased quantity of water to be raised daily, on the average, to 1½ million gallons; making the total average 4 millions a day. No alteration was required by the Committee in the charges. The promoters also made it clear that they would not build or erect pumping or other machinery for the supply of water on any land acquired under the Bill. They further undertook to insert a clause providing that water for public purposes should not be limited.

INSURANCE ACT (PART II.) AND GAS WORKERS.

Umpire's Decision on a Reserved Point.

With reference to Note II. in the report issued by the Gas Companies' Protection Association, in conjunction with the Institution of Gas Engineers, as to decisions of the Umpire with reference to the applicability of Part II. of the National Insurance Act to workmen employed in gas undertakings [see last week's "Journal," p. 107], Mr. F. E. Cooper, the Secretary of the Gas Companies' Protection Association, has now forwarded a copy of the decision of the Umpire relating to the question set out in this note, which was reserved by him.

NATIONAL INSURANCE ACT, 1911.

Part II.—Unemployment.

Decision by the Umpire.

No. 373.—On the facts before me, my decision is that contributions under Part II. of the National Insurance Act, 1911 (Unemployment Insurance), ARE NOT payable in respect of workmen engaged in the work of repair of blast-furnaces, lime and brick kilns, gas-retorts and retort-settings, and chemical or electrolytic plant (not being machinery).

This decision is intended to modify decision No. 64 published in the "Board of Trade Journal" on June 13, 1912, relating to brick-works.

No. 374.—Contributions ARE payable in respect of workmen who are engaged in the construction, reconstruction, or alteration of blast-furnaces, lime and brick kilns, gas-retorts, and chemical or electrolytic plant.

"Alteration," in the opinion of the Umpire, refers to work which involves a substantial change or variation in the original design.

(Signed) W. B. Yates.

Additional Decisions by the Umpire.

The current issue of the "Board of Trade Journal" contains a number of further decisions by the Umpire, who has decided that contributions are payable, among others, by the following:

Workmen employed in a mechanical engineering establishment, and described as gas-fitters, gas-producer men, machinery testers (if employed wholly or mainly by way of manual labour), and machinery painters.

Workmen engaged in painting machines when finished by erectors.

Contributions are not payable in respect of the following:

A workman engaged by a firm of oxide of iron manufacturers, and engaged in preparing stones for grinding purposes.

Workmen employed at dye-works, and described as gas-engine and well-pump hands who are engaged wholly or mainly in attending producer plant and well pump and driving a gas-engine.

Workmen engaged in the vitreous enamelling of cast and sheet iron used in the manufacture of domestic and other gas-stoves, paint enamelling on iron used in them, nickel and silver plating iron for them, testing gas-burners for stoves, packers, and stock takers.

Workmen engaged wholly or mainly in making incandescent gas-burners.

We have received from the Secretary of the Gas Companies' Protection Association (Mr. F. E. Cooper) some further decisions of the Umpire. He has decided that contributions are not payable in respect of the following classes of workmen employed by a local authority, and engaged wholly or mainly in the work specified.

Re-dressing old granite and whin kerbs.

Preparing and repairing square stone bases for the erection of gas-lamps.

Setting up poles to be used solely for gas or electric lamps for street lighting purposes.

Repairing and maintaining overhead, third rail, conduit, surface contact, or cable equipment of railroads, tramways, light railways, or electric power supply, the cost of which is usually chargeable to revenue account.

Preparation or repair of removable gas and electric stoves.

Shoeing horses.

Making lamp-irons and bolts for the erection of lamp-pillars.

Dismantling and assembling gas, water, and electric meters.

Repairing car conductors' punches and automatic gas and electric controllers for lighting and extinguishing lamps.

Laying services, or laying mains the cost of which is usually chargeable to revenue account.

Repairing railway sidings.

Repainting ironwork which is not part of a building.

Repairing and maintaining roads, streets, and sewers.

Cranemen employed in water and gas departments' depôts and yards.

Jointing cables for the purpose of repairs or taking branches from mains in consumers' premises.

Workmen repairing gas and electric meters.

Brass finishers regrinding old taps and grinding valves of gas-meters and finishing and assembling cable accessories for underground and for use in consumers' premises.

Contributions are, however, payable in respect of the following classes of workmen employed by local authorities:—

Cranemen employed in the repairing shops in electricity, water, and tramway departments, and who are engaged wholly or mainly in the work of lifting materials in connection with the repairs of machinery.

Workmen engaged wholly or mainly in working at small circular saws cutting out small timber to size for framing and repairing tramcars.

Workmen engaged wholly or mainly in the work of repairing baths and underground lavatories.

Workmen engaged wholly or mainly in the work of jointing new cables in electricity and tramway departments.

Workmen who are engaged wholly or mainly in the work of wiring buildings or tramway cars.

Workmen who are engaged wholly or mainly in work in connection with overhead, third rail, conduit, surface contact, or cable equipment of railroads, tramways, light railways, or electric power supply, the cost of which is usually chargeable to capital account,

Workmen who are engaged wholly or mainly in laying or constructing water, gas, and electric mains (other than services), the cost of which is usually chargeable to capital account.

Workmen who are engaged wholly or mainly in the work of constructing new railway sidings or lines.

Workmen engaged wholly or mainly in the work of constructions, reconstruction, or alteration of roads, streets, and sewers. [The word "alteration," in the opinion of the Umpire, does not refer to work usually chargeable to revenue account.]

Mr. Alex. Wilson, of Glasgow, who drafted, for the Committee of the Gas Companies' Protection Association, the report which appeared in the "Journal" last week (p. 107), has taken out in detail the decisions of the Umpire, so far as they affect gas undertakings. He purposes having them printed and posted in the various gas-works of the Glasgow Corporation, for the benefit of both managers and men; and he has sent them to us for inclusion in our list, for the sake of other undertakings.

Contributions are not payable in respect of the following:

Meter readers who read all meters in consumers' premises.

Brass founders and other brass workers casting and finishing gas and electric light fittings in brass or other copper alloy for use in connection with buildings, ships, and vehicles.

Brass founders and other brass workers casting and finishing brass taps and other water-fittings required by plumbers in fitting up buildings, ships, and vehicles.

Engine attendants who are engaged wholly or mainly in the working of engines and boilers.

Gas-meter makers, including tinplate workers and those engaged in fitting and turning the internal mechanism (*i.e.*, brass parts) used in the manufacture of these meters.

Workmen employed wholly or mainly in the following work:—

Repair of blast-furnaces, lime and brick kilns, gas-retorts and retort-settings, chemical or electrolytic plant (not being machinery). Repair of railroads, relaying a working railroad.

Driving, tenting, or minding engines or stoking boilers.

Steam, gas, or oil engine drivers; stokers or gas plant attendants; steam and petrol waggon drivers; motor car drivers.

Dynamo and electric motor attendants who are not engaged wholly or mainly in the maintenance and upkeep of machinery.

Attending to stills and condensers of the distilling plant, who are not engaged wholly or mainly in the maintenance and upkeep of machinery.

Filing, making, polishing, lacquering, and putting together electroliers, chandeliers, brackets, and mirror fire-screens.

Road repairing, cleansing, and watering; sewer cleansing.

Lamplighting and extinguishing.

Water and lighting inspectors and assistants.

Excavating limestone from quarry, transporting same to open kilns, burning same therein, and transporting to railway, &c.

Cleaning windows, washing paint, and washing buildings.

Redressing old granite and whin kerbs.

Preparing and repairing square stone bases for the erection of gas-lamps.
Setting up poles to be used solely for gas or electric lamps for street lighting purposes.
Preparation or repair of removable gas and electric stoves.
Shoeing horses.
Making lamp irons and bolts for the erection of lamp-pillars.
Dismantling and assembling gas, water, and electric meters.
Repairing automatic gas and electric controllers for lighting and extinguishing lamps.
Laying services or laying mains, the cost of which is usually chargeable to revenue account.
Repairing railway sidings; also ironwork which is not part of a building.
Repairing and maintaining roads, streets, and sewers.
Cranemen employed in water and gas departments, depôts, and yards.
Repairing gas and electric meters.
Brass finishers grinding old taps and grinding valves of gas-meters.
Fuel handlers, unloading fuel; and elevator men, working automatic elevators.
Feeding producers, and withdrawing and wheeling away ashes; and washermen, scooping soot.
Tower and tank men attending to the towers and skimming tar.
Blowermen, oiling and attending Roots blowers and pumps; and compressor men, oiling and attending compressors.
Gas-engine men attending gas-engines and electric plant.
Stokers; meter testers; inspectors and assistants, cleaning and distributing apparatus, inspecting and reading meters; labourers, cleaning-up, &c.
Sulphate of ammonia men, and packers of sulphate.
Drawing and charging gas-retorts and attending furnaces.
Discharging coal from railway trucks, and labour generally.
Preparing paving-stones for footpaths and setts for carriage ways.
Workmen described as: Timekeepers, watchmen, storekeepers, draughtsmen, tracers, gatemen, weighmen, passenger hoist attendants, closet attendants, office attendants, commissionnaires, clerks (male and female), typists (do.), office errand boys, farriers and farriers' mates engaged wholly or mainly in the work of shoeing horses, engine cleaners who are engaged solely in engine cleaning (not repairing or fitting, nor having the control of any machinery), chef and assistants engaged wholly or mainly in cooking food, condenser attendants, engine and locomotive drivers, greasers, shift engineers, gangers (if not employed wholly or mainly by way of manual labour), street lighting attendants, yardmen, canvassers, and collectors.

Contributions are payable in respect of the following:

Workmen employed in the construction, repair, or decoration of railway waggons, goods vans, brake vans, and cattle vans.
Workmen described as smiths and mechanics who are engaged wholly or mainly in the work of maintenance and upkeep of machinery.
Workmen described as bricklayers, plumbers, painters, scaffolders, plasterers, and the labourers of each, who are engaged wholly or mainly in the work of construction, alteration, repair, decoration, or demolition of buildings.
Fitters, turners, machinists, smiths, strikers, millwrights, and their helpers and labourers, who are engaged wholly or mainly in the maintenance and upkeep of machinery. Contributions are also payable in respect of carpenters, joiners, and masons, and their helpers and labourers, who are employed as above and are engaged wholly or mainly in the construction, alteration, repair, decoration, or demolition of buildings.
Workmen described as wheelwrights who are engaged wholly or mainly in repairing carts and waggons.
Labourers who are engaged in tarring, lime washing, rough painting, and glazing buildings.
Workmen who are engaged wholly or mainly in laying or constructing new water, gas, and electric mains (other than services), the cost of which is usually chargeable to capital account.
Workmen who are engaged wholly or mainly in the work of constructing new railway sidings or lines.
Workmen engaged wholly or mainly as pipe-fitters on the maintenance and upkeep of steam-pipe lines.
Workmen who are engaged in the construction, reconstruction, or alteration of blast-furnaces, lime and brick kilns, gas-retorts, chemical or electrolytic plant. [The word "alteration," in the opinion of the Umpire, refers to work which involves a substantial change or variation in the original design.]

The Forthcoming Meeting of the British Association.—The programmes of the various sections of the British Association are approaching completion, in view of the meeting in Sheffield from the 4th to the 11th of September. In the Engineering Section, of which Professor Barr is the President, there will be a discussion on the gas-turbine, with Dr. Dugald Clerk and Herr Holzwarth, of Mannheim, as the principal speakers. The Committee on Gaseous Explosions will present a report on the turbulence of gases in engine cylinders and other matters.

Gas Companies' Accounts for 1911.—We have received from Messrs. John Allan and Co. the "Gas World Analyses of Gas Companies' Accounts for 1911." The accounts of 53 gas companies are analyzed; all the items of revenue and expenditure being worked out at per 1000 cubic feet of gas sold, and the results set out on two large linen-backed sheets. As in the case of the "Analyses of Municipal Gas Accounts" issued early in the year, cardboard rules are supplied to facilitate comparison with figures of any of the undertakings given. The work is priced at 10s. 6d. net.

ELECTRICITY SUPPLY MEMORANDA.

Discrepancies in Savings—Stereotyping Antiquated Gas Cooking Figures—Central Station Engineers Require Free Energy to Encourage them to Cook Electrically—Electrical Accidents in Factories—Wrestling for Street Lighting.

THE electrical people ought really to be warned regarding the publication of widely incomparable figures as to meat wastage when cooking by electricity, and at the same time might be asked to exhibit a little more courage and courtesy in connection with the ascribed wastage of meat in baking by the heat produced by gas. They might also be urged by their friends to go beyond meat-baking, and show a little more frequently and openly the total costs of electric cooking, from initial expenses throughout; for as Mr. H. H. Holmes illustrated, in his recent paper before the Municipal Electrical Association, the cost of baking a joint of meat is not the beginning and the end of the costs of culinary operations to the consumers. But about the "meat" wastage, or rather the weight of vaporous emanations from meat when exposed to heat. The figures for electric meat baking by different forms of oven are showing very wide discrepancies, which do not look well. They testify that, just as in gas cooking, the cook using an electric-oven can do precisely as he or she likes in the matter of weight by cooking at certain preferred temperatures, and to the degree that satisfies. Some fresh figures have been published—obtained with the "Eclipse" electric-cooker. The figures assert a loss of 14·2 per cent. for pork; while a smaller joint of pork refused to lose more than 10 per cent. Then we have beef that gave up 8 per cent. of its weight in cooking; while mutton declined to part with more than 5 per cent. of its liquid content. These figures cannot match the miracles of Mrs. Mole and of Mr. Napier Prentice about which some information was lately published, and was referred to by us in the "Memoranda" on June 18. The "Eclipse" figures are far too heavy if they are to compete with what Mrs. Mole and Mr. Prentice succeeded in accomplishing with another form of cooker. At the same time, there is difficulty in reconciling the low percentage losses published in connection with different electric-ovens with the higher percentage losses realized by such an expert as Mrs. W. T. A. Cross. This lady says in the miniature lectures published by the Electric Publicity Committee, and to which allusion was made last week, that, "in my electric kitchen, . . . we find the loss varies from 10 to 18 per cent., or, roughly speaking, about half what it would be by any other kind of cookery." There is surely something out of joint in the electrical system when so much disparity is published by those of our electrical friends who have suddenly become cookery experts.

But these electrical people are not a very courageous lot. They have not yet made tests with gas-ovens, with and without enclosed tins, or with any other rational method of using a gas-oven; nor have they employed recognized expert cooks who are prepared to append their names to reports on gas-cookery tests, with a description of the oven employed. They shield themselves from all this by taking published figures from old cookery books. Even Mrs. Cross, who ought to know the very latest that can be done with a gas-stove, disregards modern developments, and says in one of her miniature lectures: "The *usual* wastage on a joint cooked by coal or gas is from 25 to 33 per cent. These figures are given in the latest edition of 'Mrs. Beeton's Cookery Book.'" Now Mrs. Cross must know that the ability to regulate temperatures in the gas oven enables a cook to do with it what cannot be done in a coal-heated oven. If she does not know this, then it is time that she did; and when she is aware of it (if it is not within her present knowledge), she will surely realize the unfairness of having placed unregulatable coal-fired ovens and regulatable gas-fired ovens on the same platform in connection with this question of wastage. In making comparison with the pork and other tests in the "Eclipse" cooker, the inflexible "losses" by gas and coal ovens (which have been quoted before by the courageous electricians) are again made use of. For pork—whether extraordinarily fat or lean—comparison is made with an "average loss with gas or coal oven" of "28 per cent." For beef the "average loss, with gas or coal oven," is quoted at 25 per cent. For mutton, "the average loss for gas or coal oven" is placed at "22 per cent." It is extremely inconsiderate of pork, beef, and mutton to perspire twice to four times as freely when exposed to the same temperature in a gas-oven as in an electric-oven.

"Meteor," we infer from a paragraph in his notes, declines to enter into discussion of our criticism of the reasons he recently advanced, and which were absurd contradictions the one of the other, as to the phenomenon of meat not to heed the factor of temperature, but to pay more attention to the type of the oven in which it is cooked, in shedding its volatile constituent. All he has done is to remove, from our article of June 25, a few words from the context, serve them up to his electrical readers, and ask them whether they, in their "impartiality," do not think the gas people are exercised over "the considerable saving in weight that electricity ensures to the housewife." How clever! Saving in weight! What of? Housewife or meat? But three paragraphs before this "considerable saving" is referred to, this same "Meteor" advocates that electrical engineers should be encouraged to employ electricity *ad lib.* in their own homes, without payment, in order that the force of their example might have some good effect in encouraging the use of the electric-cooker.

"Meteor" does not, as a general rule, believe in perquisites for officials; but he thinks this free use of energy is allowable. This is one of the funniest arguments that we have yet come across in connection with electric cooking. If there really are considerable monetary savings to be effected by committing the whole of the culinary operations of the electrical engineers' home to the heat produced by electricity, then forsooth the electrical engineer, in his own personal interest, ought to be the first to hasten to enrich himself by adopting electrical apparatus, without the sop of free energy. The "considerable saving" and the "free energy" do not harmonize. There is the other objection that, as soon as it got noised abroad that the electrical engineer was receiving his energy free for cooking purposes, the smile that people already have over the extravagant claims made for electric cooking, and over the equally extravagant derogation of gas cooking, would expand considerably. To have current free for electric cooking is one thing; to have to pay for it is quite another. We never heard such a queer proposition when the use of gas for culinary operations was being cultivated. The popularity of gas cooking simply spread without any particular effort; it was certainly not aided by giving gas engineers free gas, in order that their example in using gas for this purpose might have some beneficial result. By the way, a gas stove maker the other day mentioned to us that, since the coal strike, his normal stock of cookers for meeting the summer demand had been altogether inadequate, and that it had meant hard work to keep pace with the demand. Why are not electric ovens doing something to repress this energetic demand for gas-ovens?

The annual report of Mr. G. Scott Ram, the Chief Electrical Inspector of Factories, states that the number of accidents at electricity generating stations in 1911 was somewhat greater than in 1910—74, against 58; and the number of fatalities was 4, being the same. The electrical accidents in factories other than electrical generating stations was 290, against 276, and the fatalities 7, against 5. Portable apparatus, connectors, and flexible wires took credit for the largest number of accidents—62, of which two were fatal. The mishaps in this connection were mostly due to short-circuits causing burns. In no less than 24 cases, the short-circuits were in flexible wires, and were due to these becoming damaged. The two fatalities occurred through the use of unearthed and improperly constructed hand lamps. Even now Mr. Scott Ram finds new electrical work which is not in accordance with the Home Office regulations. Laundry irons come in for some strong criticism. It is found in some cases that no provision is made for the attachment of earth wires. The flexible wires are frequently found twisted up and the insulation damaged. This is, in fact, described as a common trouble where electric irons are used. In one case, it was discovered that the conditions were such as might lead to a fatal accident. The proprietor raised no objection to discontinuing the use of the irons, as he had decided in any case to do so within a few days, owing to *the fact that they did not get hot enough for the work*. There is a little admonition from Mr. Scott Ram. He says: "While electricity supply authorities are using every endeavour to get their consumers to adopt electrical methods of working, it seems a pity that, in such a case as this, there should not be supervision to ensure that the consumer shall get an article suitable to his needs, and also that it shall be properly and safely installed." There is also a reference to the disastrous explosion at an oil-cake mill; but Mr. Scott Ram cannot say whether or not an electric spark originated the explosion. Experiments have, however, convinced him that, in premises where dust clouds are liable to form, special precautions should be taken in regard to electrical installations to prevent the possibility of any sparking or arcing where it could ignite these dust clouds. Among the fatal accidents of the year, there was one in South London on a circuit the voltage of which, or the probable voltage of the shock, was 125-220; one at Glas gow, at 250; and two at Newcastle and one at Stockton, in which the probable voltage of shock was 250 to 440.

The battle continues between the flame arc and the metallic filament champions over the respective claims of these opposed types for street lighting; and the controversy is very entertaining to the onlooker who knows something of the frailties and the costs of both systems. The flame arcs have felt an ugly draught from both high-pressure gas-lamps and the electric metallic filament, for contrary and well-known reasons. Mr. Haydn Harrison and Mr. M. Solomon, not long since, gave a start to the present controversy by their writings, which were noticed in the "Memoranda" at the time of their publication. Business considerations, of course, play a part in advocacy; self-preservation being a natural instinct. Mr. Solomon is interested in the flame arc lamp industry; and Mr. Haydn Harrison combines (there is nothing reprehensible about it) the profession of an electric illuminating engineer with the design, recommendation, and sale of special fittings for the use of metallic filament lamps for street purposes. Therefore, Mr. Solomon thinks that the superior light is given by the flame arc; Mr. Harrison sees a greater fitness in the metallic filament lamp for most purposes, though not opposed to the more meretricious form of lamp under certain circumstances. However, succeeding the writings of these two gentlemen, a "Special Correspondent" of the "Electrical Times" thinks it time that the movement for the dispensing of flame arc lamps was stopped; and that they must be kept for the main streets and the metallic filaments for the side streets. In this way, and only by co-operation between the lamp partisans, dissatisfaction with the lighting of main streets by groups of metallic filaments will be checked, and the energy of the gas suppliers will be forced to abate. This Special Correspondent is a barbarous, selfish individual. The old dictum, "Live, and let live" has no place in his unsympathetic nature. "Gas," he says, "must be driven off the streets." That is what he says. What will happen is another matter.

This selfish creature constructs comparison tables of costs of flame arc and metallic filament lamps, to show the metallists the error of their ways in this matter of supplanting the flame arcs. He contrasts 100 8-ampere flame arc lamps running 4000 hours with a similar number of high-power metallic filaments; and he arrives at totals showing annual costs of about £14 per flame arc, and £18 per metallic filament with a wide difference in favour of the former in the candle power.

Eight-Ampere Flame Arc Lamps.

	£	s.	d.
Average 1500 to 2200 m.h.c.p—364 watts.			
100 lamps. Average depreciation at 15 per cent. =	120	0	0
Carbon cost, 4000 hours × 100 × 0·13d. . . .	216	13	6
Energy 364 × 100 × 4000 hours = 145,600 units at 1½d.	910	0	0
Trimming, attendance, maintenance	150	0	0
	£1396	13	6

Metallic Filament Lamps.

Single lamps, 540 c.p. 600 watts, average life 1333 hours.			
100 fittings, average depreciation at 10 per cent. .	20	0	0
Renewals, three lamps per fitting per annum at 15s.	225	0	0
Energy 600 × 100 × 4000 hours = 240,000 units at 1½d.	1500	0	0
Cleaning and attendance	50	0	0
	£1795	0	0

Then Mr. Harrison comes along, and tells "Special Correspondent" that he has made grave mistakes. Mean hemispherical candle power is one thing; useful candle power for street lighting another. Carbon costs, too, do not agree with Mr. Solomon's expert experience. Further, energy should be supplied for street lighting at 1d. per unit, though the private lighting consumer may be paying 4d. or 5d. (perhaps more) per unit. Two renewals of metallic filament lamps in 4000 hours is considered by Mr. Harrison as ample. But the important consideration is the useful candle power, obtained by the aid of reflectors. "Useful candle power," we may remind our electric friends, is a strong feature of the inverted gas-lamp—high and low pressure. Putting "Special Correspondent" right on these points, Mr. Harrison constructs these tables.

Eight-Ampere Flame Arc Lamp.

	£	s.	d.
Average useful light 1300 c.p. 364 watts 100 lamps. Average depreciation at 15 per cent. per annum	120	0	0
Carbon cost 4000 hours 0·20d. × 100 per annum	333	6	8
Energy—145,600 units at 1d. per annum . . .	606	13	4
Trimming, attendance, and maintenance per annum	150	0	0
	£1210	0	0

Metallic Filament Lamps.

Group lamp 900-candle power depreciation at 10 per cent. per 100 fittings per annum. . .	20	0	0
Renewals—two sets of lamps per fitting . . .	150	0	0
Energy—240,000 units at 1d. per annum . . .	1000	0	0
Cleaning and attendance per annum	50	0	0
	£1220	0	0

So he calculates that the costs will be practically the same, with 25 per cent. [?] less useful illuminating power against the metallic filament lamp. After Mr. Harrison, along comes Mr. Solomon, and smiles at the "useful" rays for which the former has so strong affection, and accuses him of sundry minor indiscretions in his arguments. When the electric illuminating experts differ, who among the lay street lighting authorities can decide? The conflicting interests will maintain the conflicting advice; and as the "Electrical Times" would put it, their so-called "true costs" are not the "actual ones" for which payment has to be made. And the illuminating power afforded is not of the strait-laced kind suggested in the tables.

Electrical "Progress" in England.—The Melbourne Electrical Engineer (Mr. H. R. Harper) completed last year a tour in Europe and America, and has recorded his observations in a substantial folio volume which is noticed in the article by the writer of "Electrical Notes" in the Engineering Supplement of "The Times" as follows: "Mr. Harper thinks that the figures of British electrical output 'do not indicate the development that might be expected from a country so rich in manufacturing and industrial pursuits.' He is particularly struck with the political limitations affecting electrical progress here, and he makes a very severe contrast between the situation in London, where 15 municipal and 13 company undertakings are supplying electricity to a population of 4½ millions, and the districts of Berlin, with one supply authority for 2¾ millions, Vienna with one for 3 millions, Chicago with one for 2¾ millions, New York with one supplying 95 per cent. of a population of 4 millions, and Boston, where one undertaking serves 36 towns over an area of 600 square miles."

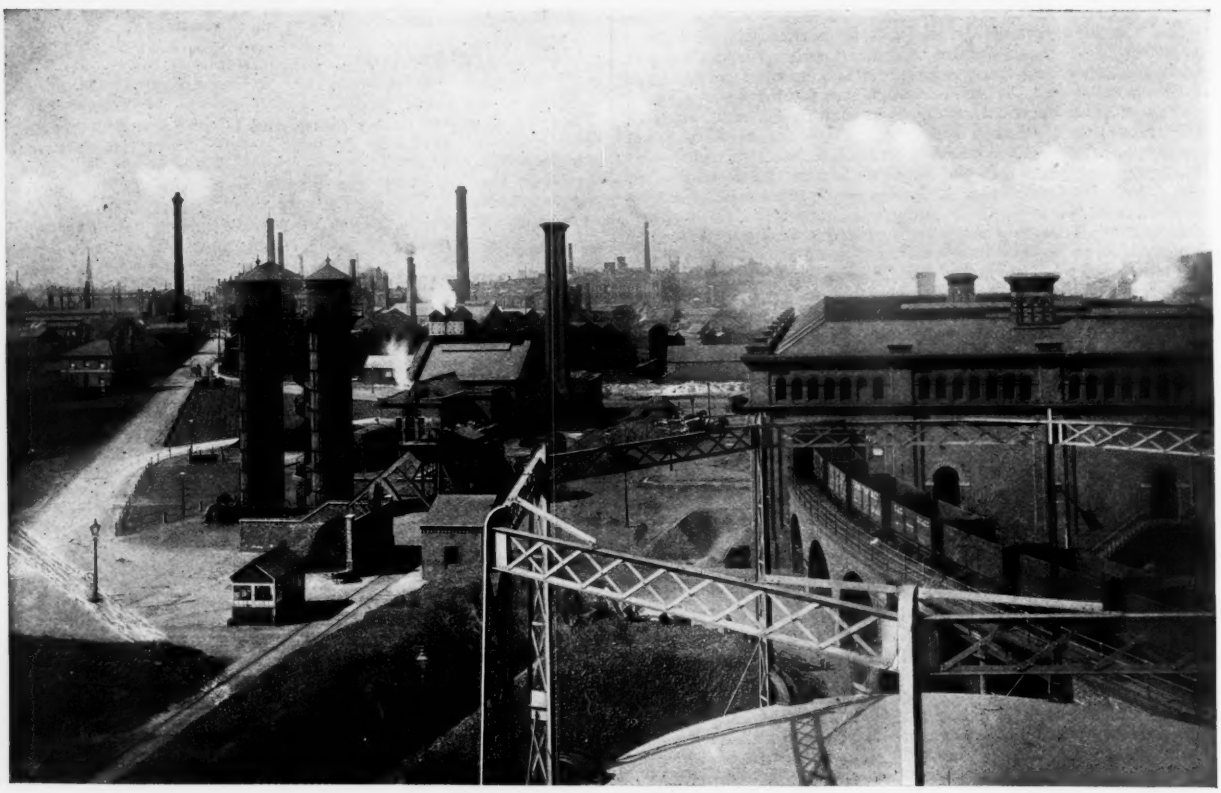
THE READING JUBILEE.

As was stated in last week's issue of the "JOURNAL" (p. 106), the jubilee of the Reading Gas Company, as it now exists, and the fifty years' chairmanship of Mr. J. Okey Taylor, J.P., were celebrated on Monday, the 8th inst., when an interesting programme was carried out. Inasmuch as practically all that has been done to celebrate the reaching of this stage in the Company's career is for the workmen, the event was not made a big public affair. In fact, the only persons invited outside the Company were Mr. Corbet Woodall and Mr. J. R. H. Jacobs, Secretary of the Southampton Gas Company, and late Assistant Secretary of the Reading Gas Company, who attended and took part in the proceedings. It was thus quite a little family party—but a very enthusiastic one—that participated in the pleasing functions that were arranged at the gas-works in King's Road. Had it not been for the publication of the fact, no one, seeing the keenness and activity of the Chairman and the Vice-Chairman (Mr. H. Bilson Blandy, J.P.), would have guessed that they are both octogenarians. What both of them are and have been to the town as well as to the Gas Company will be gathered from our article last week.

The Reading Gas-Works.

In connection with the celebrations, a booklet dealing with the history and position of the undertaking had been prepared by the Company's Engineer, Mr. Douglas H. Helps, Assoc.M.Inst.C.E.; and some reference was made to this in our last issue. It will, however, not be out of place to allude again to this compilation, and to reproduce some of the particulars given of the works, as well as one or two of the photographs by which the book is enriched.

The Reading Gas Company was the result of the amalgamation in 1862 of the two Companies which previously supplied the town with gas; and Mr. Okey Taylor and Mr. Blandy have both been on the Board from the commencement—the former having all along occupied the position of Chairman. For some time after the amalgamation, gas was manufactured both at the works of the old Reading Gaslight Company in Bridge Street, and on those of the late Reading Union Gas Company, which were then on a site opposite to the existing Engineer's office, and on a portion of which the present governor-house stands. Eventually, however, all the gas was made at the latter works, which were enlarged to the designs of Mr. R. P. Spice. Considerable extensions followed upon the appointment of Mr. Edward Baker as Engineer and Manager in 1865; and in 1880 the Company obtained an Act authorizing them to purchase the land on which the works now stand. Mr. Baker had been for some time engaged in designing new plant; and in 1881 the construction of the present works was



VIEW OF THE READING GAS-WORKS.

It shows one of the High-Level Railway Approaches to the Retort-House. The Photograph is taken from the Top of a Gasholder, looking westwards.

commenced. Early in 1888 all the new works were brought into use. Mr. Helps was appointed Engineer and Manager in March, 1903; and towards the end of that year a large governor-house, with an extensive scheme of separate distributing mains, was erected; and the old governor-house, which was the last of the original plant at the King's Road works, was dismantled. In the same year, the Company's mains were extended to Tilehurst. Some figures were given last week to show the enormous growth of the Company's business. To meet the rapidly increasing demand, an oil-gas plant was installed in 1905, in which year, also, new offices and show-rooms were erected in Friar Street. Shortly afterwards, the area supplied by the Company was enlarged by the extension of the mains to Three Mile Cross and Spencer's Wood, and further additions have since been made.

The site on which the works stand is triangular in shape, and covers about 13 acres of land. It is bounded on the north by three Railway Companies' lines (which are connected with the works by high and low level sidings), and on the south-east by the River Kennet. The retort-house and coal-store are 296 feet long by 112 feet wide between the walls. There are two retort-stacks, each containing eleven settings of eight Ω-shaped brick retorts, 22 in. by 16 in. by 20 feet long. The settings are on the Klönne regenerative system, each having separate hydraulic mains fitted with regulating seal valves, and glass inspection chambers. The coal is weighed on its entrance to the retort-house, the trucks being lifted on end by steam machinery and emptied directly into the coal-breakers. After passing through the breakers, the coal is carried, by means of elevators, to continuous overhead storage hoppers. The retorts are charged and drawn by means of De Brouwer patent stoking machinery. In fact, the Reading Gas Company were one of the first to instal these machines in this country. The coal-projectors are of the original slung type, and were brought into use in 1904—the discharging machines being shortly afterwards installed. The stoking machinery and the conveyors which carry the coal to the projectors are driven by electricity, generated by two gas-engines, each of 33½ H.P.

On the walls of the retort-house, there are 338 feet of 18-inch steel and 825 feet run of 18-inch cast-iron condensing mains. From the retort-house, the gas passes through a 20-inch main to a Morris and Cutler water-tube condenser, going from this to the exhauster-house, where there are three Beale exhausters driven by Gwynne's vertical engines. The capacities of the exhausters are respectively 45,000, 63,000, and 84,000 cubic feet per hour. The gas, after leaving the exhausters, passes through three Livesey washers, two tower-scrubbers, and a Kirkham, Hulett, and Chandler patent washer-scrubber. There are eight purifiers —three measuring 28 ft. by 26 ft., and five 28 ft. by 28 ft. Lime is used in seven of them, while the eighth is charged with oxide of iron. The meter-house contains two Parkinson and Cowan

The Engine and Exhauster House.

station-meters, each of 60,000 cubic feet per hour capacity; and there are three gasholders, of capacities of 338,000, 738,000, and 1,100,000 cubic feet.

The generating portion of the oil-gas apparatus is of the Humphreys and Glasgow type, with all the firm's latest improvements. At present two sets have been installed, each guaranteed to produce 550,000 cubic feet of gas per day; and provision in the building has been made for two more sets of equal or larger capacity. This plant is provided with separate exhausters, relief holder, purifiers, and station-meter. The governor-house erected in the year 1903 contains a large distributing cylinder and three governors, which regulate the supply of gas to the town and western district, the east district, and the Caversham district respectively. The sulphate of ammonia plant was designed to distil 55 tons of liquor per 24 hours.

Workmen's Club and Mess-Room.

The first item on the programme was the opening of the employees' club (which has been altered, and to which has been added a new mess-room) and the unveiling there of a commemorative tablet.

The building is situated at the entrance to the works, and previous to the alterations it contained only one storey, which consisted of a small mess-room and reading-room—the former being too small to accommodate all the members of the Workmen's Club. By the addition of the new mess-room, 49 feet long by 25 ft. 10 in. wide, on the second floor, the accommodation has been more than doubled. The room is fitted up with a large cooking-range supplied by Messrs. Fletcher, Russell, and Co., and contains suitable grilling and water-boiling burners. It will not only be used as a mess-room, but meetings, smoking concerts, &c., will be held; and the workmen's annual dinner, which in the past, owing to lack of accommodation at the works, has taken place at a hall in the town, will now be held in the new mess-room. An excellent bath-room, with shower and slipper baths, has been provided, as well as washing basins and lavatories. It was announced that, on the evening of the opening, there was to be a smoking concert to celebrate the event. The hot water supply for the baths, lavatories, &c., is obtained by means of one of Messrs. Ewart's "Califont" water-heaters. With this apparatus, a small bye-pass is kept constantly in use; and when one of the hot-water taps is turned, this automatically turns on a full supply of gas to the heater, which, it is estimated, will deliver 6 gallons of hot water per minute. One of Messrs. Ewart's bar-boilers is fixed in the mess-room, to provide boiling water for making tea, &c. There is also a comfortable reading-room in the building, which is supplied with most of the leading London dailies and local weekly newspapers, in addition to numerous periodicals and magazines. Then there is a large games-room, attached to which is an excellent air-rifle range. The men take a keen interest in shooting; and competitions are held annually for a handsome silver cup presented by the Directors. Mr. T. Ware, who won the cup this year, has won it on two previous occasions, and in addition was successful in winning the trophy presented by the proprietors of the "News of the World," together with a gold medal. The members of the club are, therefore, naturally proud of their air-rifle champion.

When the party were assembled in the mess-room, Mr. Helps explained that this was the principal addition that had been made. It was all new, and would be used by the men every day as a mess-room. It would also be used for various social purposes. He then asked the Chairman to unveil the tablet put up at one end of the room to commemorate the event.

The Chairman, having declared the building open, and expressed the hope that the workmen would appreciate this addition to their comfort, unveiled the tablet, which is handsomely executed in alabaster, and bears the following inscription.

> The enlargement and improvement of this Club and of the Stokers' Lobby form part of the general scheme for commemorating the Jubilee of the Reading Gas Company and Mr. J. Okey Taylor's fifty-years Chairmanship. July 1, 1912.

The Enlarged Stokers' Lobby.

A move was then made to the stokers' lobby, which is situated on the works, close to the retort house. This has been greatly enlarged. The mess-room has been improved, and a large dressing-room provided. Leading from the latter is a room fitted up with a number of large washing-basins, and slipper and shower baths, supplied with hot, tepid, and cold water. New lavatories have also been constructed. The water-heating apparatus is by the Keith-Blackman Company. It is clear, from remarks made by employees on the spot, that they fully realize their good fortune in having Directors and officials who devote themselves so much to looking after their welfare.

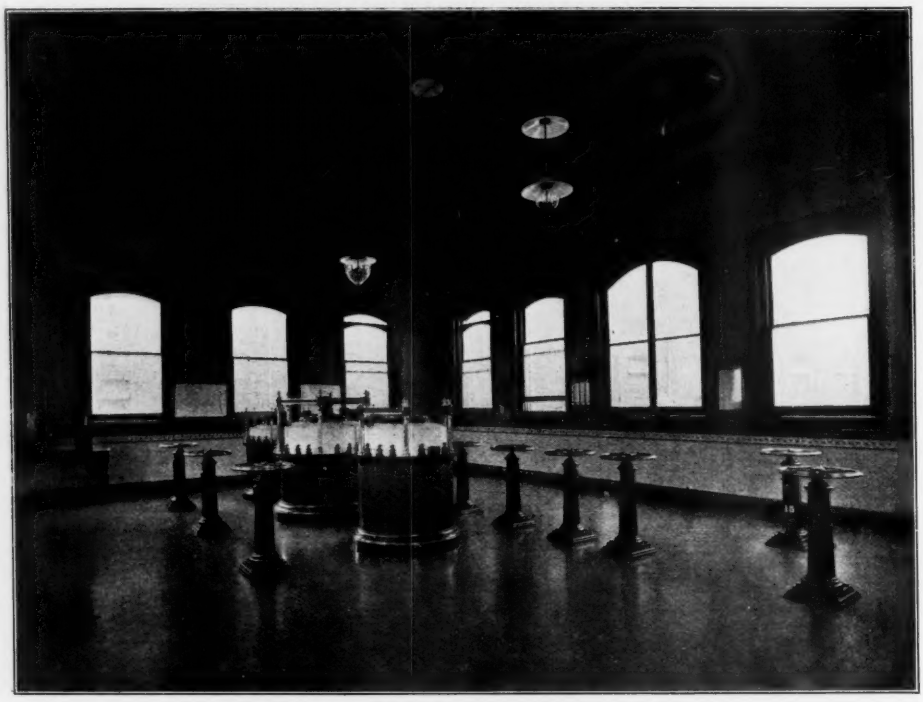
After the lobby had been inspected, and formally declared open by the Chairman, the little speech-making which was included in the celebrations took place.

Presentation to the Chairman and a Bonus and Booklet Distribution.

On the lawn in front of the engine-house, a marquee had been erected, and from a platform at the entrance to this the Chairman of the Company addressed the employees—afterwards presenting bonuses to the men in proportion to their length of service, and handing copies of the historical booklet to those who had been with the Company five years or more. This done, he announced that there would be a half-holiday for all those able to leave their work. First of all, however, Mr. Okey Taylor was himself the recipient of a handsome gift in the shape of his portrait in oils, which was unveiled by Mr. Blandy. The portrait was painted by Henrietta Rae (Mrs. Ernest Normand). So far back as 1880, the name of Henrietta Rae appeared for the first time in the Royal Academy catalogue; and since then Mrs. Normand's success has been rapid, and she has undertaken many important commissions. Supporting the Chairman were the Vice-Chairman, Mr. Corbet Woodall, Mr. Helps, and the Secretary (Mr. A. B. Stedman).

The CHAIRMAN, in addressing his audience as "brother workers of this Company," said he might well do so, because he had been a worker for a great number of years—probably more than anyone else present. First of all—and it was most important—he wished to acknowledge the honour that had been done to the Company by the presence with them that day of Mr. Corbet Woodall, who was, as they knew, the Governor of the largest Gas Company in the world. He was sure they all thanked him for coming to Reading. [Applause.] Before proceeding further, he believed Mr. Blandy had an operation he wished to perform, and which would give pleasure at all events to him (the speaker).

Mr. BLANDY remarked that one of the means which had been adopted



The Governor-House, Showing the District Governors and Valves.

of commemorating this jubilee—it was not only the jubilee of the Company, but of Mr. Okey Taylor's chairmanship of it—was that of presenting the Chairman with his portrait in oils. He had been asked to unveil it; and he now had great pleasure in doing so. [Mr. Blandy then, amid cheers, uncovered the portrait.] Continuing, he said he was sure they would all agree that it was an exceedingly good likeness of their Chairman; and perhaps he might add that it was the work of a lady. In his own name and that of his co-Directors, he had to ask Mr. Okey Taylor's acceptance of the gift.

The CHAIRMAN said a great honour had been done him by the presentation of the portrait. His good friend Mr. Blandy, who had so kindly made the presentation, had been associated with him in his connection with the Company during the whole of the fifty years he had been Chairman. He thanked him for what he had said, and for the part he had taken in bringing about so pleasing a gift as the portrait which stood before them. This, he presumed, was destined to be placed in the board-room of the Company, where for many a year would it be seen. He could only trust that those who looked upon the portrait and saw that one man had been for fifty successive years Chairman of the Company, and had enjoyed the respect and the esteem of his colleagues throughout this period, would take it as a proof that those who served (as he himself had endeavoured to serve) faithfully and to the best of their ability, met with a reward beyond their anticipations. He would like to say to those around him that the duties of the good citizen, when performed to the best of one's ability, would always be valued; and he hoped there were many present who would spring forward from the ranks and endeavour to raise themselves in their sphere of life, and be prepared to perform the duties of good citizens. Then, when they arrived at the time of life that he (the speaker) had reached, they could look back upon their achievements with great satisfaction and pleasure. It was rather a coincidence that the centenary of Mr. Corbet Woodall's Company, the great Gaslight and Coke Company, should come about in the same year as the Reading Gas Company's jubilee. At the time of the Gaslight and Coke Company's jubilee, fifty years ago, the gas interests were in greatly troubled waters. A man had sprung forward who had great power of language, and therefore obtained a very considerable amount of influence. Whence he came, very few could say; but his activities led to the establishment of a Company in London in opposition to the then existing undertakings. This was the Great Central Consumers' Gas Company, whose appearance greatly chagrined and annoyed the older Companies, who were doing their duty. But, as was the case with most things introduced without consideration, and merely from the theoretical views of an able speaker such as he was, when his theories were put into practical operation in London and two other places (their own town and Birmingham), they all fell through, and the individual himself retired into the obscurity from which perhaps it would have been as well for the gas interests if he had never emerged. During his (the speaker's) long period of chairmanship of the Reading Company, it had been one of the greatest possible sources of pleasure to him that he had always been received upon the works with the utmost courtesy by all those who were in the employ of the Company. He had never at any time experienced an ill word. He thanked the workers of the present day, and he had great feelings of gratitude towards the workers of earlier years, for their courtesy and their harmonious relations with the Directors. Circumstances had greatly changed of late, and there were at the present day opportunities given to the young men of all ranks to raise themselves in their position in life. There were, if they wished, means now at their command to study and work a little with their brains as well as with their hands, that they might achieve success in life. These opportunities did not exist years ago. The Directors of the Reading Gas Company were most desirous of assisting to bring forward as many men as they could. First of all, by study, work, and perseverance they became better men, and did their work better in the Company's employ; and there was no greater pleasure in life to himself, to the Directors, and especially to the Engineer, than to see young men who possessed ability making use of it, and if possible obtaining superior positions. Without study and work, there was little chance of them doing this. These were days when employees should use all their energy, all their powers, against the competition of the world. If the men went into the reading-room, they would learn what was being done elsewhere. They would find other nations advancing from time to time; and unless the workers in this country took the course he had indicated, and availed themselves of the means of study within their reach, they would find themselves in the long run beaten by other nations, whereas formerly this country stood at the head. The Directors desired to give every encouragement to the young men—especially those in the fitting department—in connection with the University College of the town. They were aware that there were evening classes formed for the purpose of assisting fitters, and promoting the very objects he had spoken about. He only trusted that what he had said on this matter would induce those around him to think more deeply of their future in life, and strive to bring forth all their powers of mind and body in the endeavour to secure more knowledge, more information, in the positions they held. They had inaugurated that day a new reading-room, club, &c., and greater comforts for their workers; and he trusted they would avail themselves to the utmost of the facilities offered, and that they would do all they could to promote the welfare of the club, and utilize it for their benefit. They had there what he might call sub-clubs—a cricket club, a rifle club, and so on—and they should also strive to bring out their talent in these directions. There was a good old saying that those who could play best were the best of all workers. Therefore they should try to excel, whether they were playing or whether they were working; and then in all probability a greater amount of success in life would fall to their lot. Again, they had passed through the improved stokers' lobby. He would recommend the stokers of the present day to get into contact with some of the older stokers, and hear what they had to say about the inconveniences they had to labour under in their work, and the nature of the work they had to perform, and compare the conditions of stokers (say) 25 years ago with those which would prevail when they commenced the occupation of the facilities which had now been provided for them. In celebration of the Company's jubilee, a copy of the historical booklet dealing with the undertaking, which had been prepared by Mr. Helps, was to be presented to each of those who had been in the employ of the Company five years and upwards. This booklet had been very ably compiled by their excellent Engineer. It did him great credit to have brought all the facts together in the manner he had; and this opinion the workers would share, when they had an opportunity of reading through the booklet. It was intended, in addition, to present to the workers a bonus. No doubt, they would like to know what this meant. First of all, he would say that the sum which the Directors would place in the hands of the foremen of the different departments amounted in the gross to nearer £500 than £400. The distribution was to be made, after great consideration, upon the footing, first of all, of long service, and, secondly, upon the amount of wages paid, to all those who had been one year in the employ of the Company. The duty had fallen upon him of handing over to the various foremen cheques and booklets; and they would distribute them to the individual recipients. This was a very easy mode of distribution. He hoped that the proceeds of the cheques would be utilized partially that afternoon in amusement; and therefore during the remainder of the day the Company wished only those who were compelled to do so to stay on working, and the others to take a holiday. Might they all enjoy themselves. [Applause.]

The Chairman then handed the parcels of cheques and booklets to the following foremen and members of the staff: Mr. W. Holdsworth,

Foreman of the Works Department; Mr. F. Haydon, Foreman of the Fitters' Shop; Mr. R. Warren and Mr. J. T. Taylor, Foremen of the Stokers; Mr. F. Aust, Foreman of the Lamplighters; Mr. P. J. Malaune, Foreman of the Mainlayers; Mr. F. Menday, Foreman of the Meter Shop; the Secretary; and the Engineer.

The CHAIRMAN, in presenting to Mr. Helps the packet for his department, said their Engineer had been greatly instrumental in bringing all this about. He had ever in his mind the comfort of those who were working with him. Many times he had presented to the Board recommendations having for their object the promotion of the welfare of the workers. Therefore he was not only entitled to their warmest thanks for the booklet and the trouble of bringing about these proceedings, but for the interest he always took on behalf of those working for the Company.

Mr. HELPS said he had a pleasant duty to perform, and that was to propose a very hearty vote of thanks to the Directors, and particularly to the Chairman, for all they had done to commemorate this occasion. Practically everything that had been done took the form of providing for the welfare of the employees. The Chairman was, of course, very well known to them; and if they were not so well acquainted with the other Directors, he could assure them that all took the greatest interest in their welfare. Whenever an old employee got past working, it was only necessary for him (the speaker) to say that he had been a faithful servant, and then the Directors said, "Well, what do you propose to do?" Those present knew what had been done. The future of that old servant had been provided for. There were in the Company many employees of over thirty years' service, and they would have seen great changes. They would remember the time, perhaps, when for every man engaged on the district there were from ten to twenty on the works. Now, they had far more men engaged on the district than there were on the works. But he need not remind the men working on the district that if it were not for the efforts of the men on the works it would not be possible for the Company to sell gas at 2s. 4d. per 1000 cubic feet, and so compete as successfully as they did with their rivals. Again, it was unnecessary to point out to the men on the works that if it were not for the great efforts made by the district men, the consumption of gas would not go on increasing as it had done, and the Company would not be able to look after their employees as well as they did. He believed they were a happy family, and hoped they would long continue so. He was sure, at any rate, that so long as the present Board had control of the Company, they would continue to look after the welfare of the workers. It was now just about thirty years, he thought, since the incandescent electric lamp was placed on the market; and at that time they were told that gas companies were doomed, and people went around selling their gas stock. What had happened? Since that period the consumption of gas had gone on increasing at a greater ratio than at any prior time. They were honoured that day by the presence of one who was known better than any one else as a great gas administrator. The Gaslight and Coke Company were doing big things in London; and he knew how greatly what had been done was due to Mr. Corbet Woodall. The City of Westminster was now lighted by gas, having ousted the electric light, with a saving to the ratepayers of £10,000 a year. This did not look as though gas were dead.

Mr. STEDMAN, who seconded the vote, said it did not need any words from him to emphasize the good work of the Chairman, and the interest that he and the other Directors took in the employees.

Mr. D. DYER, Deputy Works Foreman, who has been in the service of the Company forty years, supported the vote; and it was accorded, with cheers.

Mr. CORBET WOODALL, having been asked by the Chairman to say a few words, remarked that the occasion was one of peculiar interest. Looking at the admirable portrait that had been presented to the Chairman, his thoughts went back to the board-room in which he himself occasionally presided and which was surrounded by portraits of former Governors of the Company, and he wondered how long it would take the Reading Company, if their Chairmen went on as long as Mr. Okey Taylor had done, before a moderate sized board-room would be furnished with portraits. So might it be. When they had a good man, they should keep him as long as they possibly could, and work him as hard as they were able. It was pleasing to note that during the long history of the Company the relations between those who were the workers and those who were the employers had been so good. When one looked back fifty years, and still more when one looked back a hundred years, and noted what was the condition then of those who were the workers, as compared with the employers, the change for the better that had taken place in the intervening period was such as to make one extremely glad and thankful. But the path of progress had not been travelled to the end yet. There was still undoubtedly much to do. He was, however, quite sure that the way in which to do it was to cultivate good relations such as were shown to exist in Reading—to talk over things that promised improvement, and to come to amicable arrangements throughout. When one looked around and noted the effects of the methods that had been followed, in certain directions during the current year—the miserable, wretched, devastating, wicked waste that had brought about so much distress and suffering and loss, not simply to the men, but to the wives and children—one felt that the Reading plan was by far the better way. The Chairman suggested that the employees should spend some of their bonus on a pleasant afternoon; and he (the speaker) would suggest that what was left, at any rate, should go towards buying shares in the Company, so that in this way the employees would become partners in the success of the undertaking in a way that they were not now. He congratulated the Chairman, and he also congratulated Mr. Helps, on the excellent relations that evidently obtained under their administration.

The CHAIRMAN remarked that this ended the formal proceedings, but there was just a word of explanation he would like to add. Some people thought that the Company had obtained, from the labours of the employees, additional advantages for those who were shareholders. This was an impression he wished to remove, because the shareholders had only a fixed and comparatively small percentage. They could not get any more under any circumstances, and this amount had been assured for many years past. The employees were now working for the benefit of the community at large, and for the benefit of the town, in bringing the price down to the lowest point. The lower the figure they brought the gas to, the greater was the credit for the town; and in this credit those living in Reading must participate. The employees were working for themselves to an extent, because he expected most of them were consumers, and as such it would be a gratification to obtain gas at as cheap a rate as possible.

Mr. F. PALMER, of the Meter Shop, proposed a hearty vote of thanks to Mr. Helps and Mr. Baker for the interest they took in the workers. He also included Mrs. Helps, who, he said, concerned herself with the welfare of the employees, both in sickness and in health.

Mr. J. WOODLEY, of the Smiths' Shop, seconded the proposal, and it was carried with acclamation, and was suitably acknowledged by Mr. HELPS.

The gathering dispersed, after Mrs. Hurry (daughter of the late Mr. Arthur Hill, who was a Director of the Company for a number of years) had presented the Chairman with a handsome bouquet. Subsequently, the Directors entertained the Chairman at lunch in the Boardroom. The other guests were Mr. Corbet Woodall, Mr. Helps, the Assistant Engineer (Mr. Hamilton Baker), Mr. Stedman, the Assistant Secretary (Mr. H. Runham), the Auditors (Messrs. B. P. Allnatt and Arthur West), and the Solicitor (Mr. W. C. Blandy).

With reference to the Chairman's allusion to what had been done in the way of securing classes for their gas-fitters, it may be pointed out that in 1909 the Company arranged with the authorities of the Reading University College for the holding of classes for fitters, in the subjects of gas-fitting and gas supply. These lectures have been well attended; and the lecturer—Mr. C. H. Eves, the Gas Company's District Superintendent—deserves very hearty congratulation on the result of the classes. In the last College examination he secured 100 per cent. of passes; while of the six students who sat for the City and Guilds of London examination, there were five passes.

IRISH ASSOCIATION OF GAS MANAGERS.

Annual Meeting in Dublin.

The Annual Meeting of the Irish Association of Gas Managers was held in the Council Chamber of the City Hall, Dublin, last Tuesday—Mr. C. B. OUTON (of Inchicore), the President, in the chair. The Right Hon. the Lord Mayor (Councillor Lorcan Sherlock, LL.D.), accompanied by the Town Clerk (Mr. H. Campbell), was in attendance in order to accord a welcome to the Association.

A CIVIC WELCOME.

The LORD MAYOR said he extended his greetings to the members in all earnestness and sincerity. It might seem strange that a Lord Mayor who was the Chairman of a progressive and successful electricity undertaking should be in the position of welcoming his most active opponents—those responsible for gas. [Laughter.] But he could quite see that there was room both for gas and electricity in every progressive country, and particularly in Ireland, for very many years to come. Naturally he felt pleased to welcome any association of men connected with the gas industry who had as their aim the improvement of the appliances and arrangements in relation to it, so as to bring about a reduction in price, and thus promote the utility of gas to the public. In addition, he was particularly glad to have the opportunity of welcoming this Association, because it enabled him to say a few words in the hope that he might enlist their help in developing the industries of Ireland. He spoke with special reference to efforts which had recently been made by a Kildare gentleman to open and develop an Irish colliery. He desired to direct attention to the great possibilities that the development of this colliery offered in the production of gas, especially for use in connection with the suction-gas plants now generally used throughout the country. If there was to be any development of Irish industry, apart from such industries as appertained to cities and large towns, it must come through the utilization of suction gas; and if any of those present, through their position or influence, even if it did not come within their purview as local managers, could help in popularizing the use of Irish coal for gas production for working engines to extend Irish industries, they would be doing not only a good thing for the gas industry, but also a good thing for the development of the country at large. They would be holding out the right hand of fellowship to any man who would be courageous enough to put his capital and industry into the work of this development. If it were true, as the old saying had it, that the true patriot was the man who succeeded in making two blades

of grass grow where only one had grown before, they could gauge the amount of patriotism that must exist in the heart of a man who, with his own established business already doing well, put his ready money and his ability and energy into the development of a tremendous undertaking—the working-up and the putting on a business footing of a great colliery. This was the class of man they wanted in Ireland; and he was sure such a man would receive the support, so far as they could give it, of the gas managers of the country. He hoped that their visit to Dublin would be an exceedingly pleasant one, and that the outcome of their proceedings would be of benefit to themselves individually, as well as to the undertakings they represented. In conclusion, he wished to tender them, on behalf of himself and the citizens of Dublin, a "*cead mile failte;*" and he trusted they would all enjoy themselves during their stay in the city.

The PRESIDENT thanked the Lord Mayor for the compliment he had paid the Association by coming to inaugurate their proceedings; and he tendered to his Lordship their congratulations on his having had conferred upon him a few days previously the honorary degree of LL.D. of the Dublin University. He ventured to think there could be no worthier recipient of so distinguished an honour.

The Lord Mayor and Town Clerk then withdrew.

PRESIDENT'S ADDRESS.

The PRESIDENT then delivered his Inaugural Address, which was given in the "JOURNAL" last week (p. 111).

THANKS TO THE PRESIDENT.

Mr. J. E. ENRIGHT (Tralee), in moving a vote of thanks to the President, said the address they had just heard was both eloquent and instructive. Points had been raised which were not only educational, but which ought to be of great interest to them all in the commercial sense. The speaker referred to the President's abiding interest in gas as an illuminant, and to the fact that on the Great Southern and Western Railway, in connection with which Mr. Outon held so distinguished a position, gas still held sway. One feature of the address in relation to gas managers which he (Mr. Enright) wished to emphasize was that relating to appointments and salaries. He thought it was high time the Association took up this matter, and adopted some method of remedying a humiliating state of affairs. What they wanted was to secure that the status and salary of managers were not lowered. One salary had been advertised at £200, and the appointment was actually at £130; another, advertised at £225, fell, in practice, to £125. And there were other instances. He certainly urged that it was time they did something in this important matter.

Mr. C. W. STOTT (Parsonstown), in seconding the motion, said the address was an admirable one, and deserved the close attention of every one present and of all who would read it. It was, in fact, an ideal presidential address.

The motion was put by Mr. W. H. ROBERTS (Newtownards) and passed by acclamation.

The PRESIDENT, in acknowledging the vote, said he was much obliged by the kindness of the members.

COMMITTEE'S REPORT AND THE ACCOUNTS.

The HON. SECRETARY (Mr. George Airth, of Dundalk) read the annual report. It stated that the meeting at Queenstown last year was not so well attended as it might have been, but that this did not prevent it being one of the best in the Association's history. Besides the President's address, two papers were read: "Notes on Purification by Lime and Oxide," by Mr. A. Percy Hoskins," of Belfast; and "The Uses of Coal-Gas Appliances for Industrial Purposes," by Mr. G. F. Hurst, of Birmingham. A paper on "The Construction and Working of a Small Sulphate of Ammonia Plant," by Mr. T. Hornby, of Longford, was, by his consent, carried over to the present meeting, owing to want of time. The Committee expressed their thanks to the writers of the four papers to be read at this meeting for the spontaneous way in which they had come forward. The Committee were asked to report as to the best month in which to hold the Association's meetings; but they had deferred such consideration until they had seen the result of the change from August to July.

The HON. AUDITOR (Mr. G. W. Norman, of Dublin) reported that the year began with a balance of £49 15s. 6d., and that the income amounted to £43 11s. 6d. The balance in hand on the 1st inst. was £55 4s. 5d.

The report and accounts were adopted.

ELECTION OF OFFICE-BEARERS.

Messrs. T. DUNCAN (Glasgow) and J. O. SCOTT (Edinburgh), the Scrutineers of the balloting papers, reported the unanimous election of the following Officers and Committee for the year 1912-13:—

President.—Mr. W. H. Roberts, of Newtownards.
Vice-President.—Mr. P. J. Fitzpatrick, of Maryborough.
Members of Committee.—Messrs. H. Hawkins (Limerick), R. J. Skinner (Londonderry), and L. G. Young (Carlow).
Auditor.—Mr. G. W. Norman, of Dublin.
Hon. Secretary and Treasurer.—Mr. G. Airth, of Dundalk.

NEW MEMBERS.

The following candidates for membership were unanimously elected:—

Members.—Messrs. Arthur Graham (Mansfield), H. H. Williams (Carrickmacross), Charles Griffin (Newbridge), Cuthbert Watson (Athy), P. J. O'Callaghan (Omagh), and J. W. M'Lusky (Portrush).

Extra-Ordinary Members.—Mr. Comerford, of Dublin (Messrs. Baxendale and Co., Limited); and Mr. R. P. Chester, of Manchester (Messrs. Donald Macpherson and Co.).

APOLOGIES FOR ABSENCE.

The HON. SECRETARY announced that a telegram had been received from Mr. A. Mackenzie, the Association's oldest extraordinary member, and a message from the President of the Institution of Gas Engineers, regretting their inability to be present, and expressing their best wishes for the success of the meeting.

REPRESENTATIVE ON THE GAS INSTITUTION COUNCIL.

On the motion of Mr. AIRTH, seconded by Mr. HAWKINS, it was agreed that Mr. Roberts should be the District Representative on the Council of the Institution of Gas Engineers for the ensuing year.

Mr. ROBERTS returned thanks for the honour conferred upon him in this respect, and also for his election as President.

PLACE AND DATE OF NEXT MEETING.

Mr. ROBERTS suggested that the next meeting should be held at Newtownards or in Belfast.

A discussion took place as to whether it was desirable to continue the arrangement for the meeting on the second Tuesday of July, or whether the Association should not revert to the plan of holding the meeting on the second Tuesday in August.

Mr. ENRIGHT said those who seemed most anxious to have the meeting in July did not appreciate the change when it was made; and, for his part, he was willing to yield to the suggestion that August would be a more convenient time.

Ultimately it was agreed that the 1913 meeting should be held at Belfast on the second Tuesday in August.

Mr. ROBERTS assured the Association of a hearty welcome to the North. For his own part, he would do his best to help the members in every way to make the meeting a success. He trusted they would all enjoy a visit to that enterprising part of Ireland.

PAPERS AND DISCUSSIONS.

The papers on the *agenda* were then taken. They were as follows: "The Construction and Working of a Small Sulphate of Ammonia Plant," by Mr. T. Hornby, of Longford; "High-Pressure Lighting," by Mr. A. M'I. Clelland, of Belfast; "A Hydraulic Main Experience," by Mr. J. F. Tyndall, of Wicklow; and "Upright *v.* Inverted Incandescent Burners," by Mr. P. J. Fitzpatrick, of Maryborough. The first two of these, with reports of the discusssion upon them, are given in another part of the "JOURNAL;" the others will appear next week.

THE PRESIDENT'S MEDAL.

At the close of the business on the *agenda*,

The LORD MAYOR again attended, and having taken the chair, said it gave him great pleasure to perform the closing act of the proceedings by presenting Mr. Outon with the President's Medal, in recognition of his services during his year's term of office. It was a very happy coincidence that Mr. Outon was the outgoing President to receive this medal from his hands, because, as they knew, Mr. Outon was a very distinguished teacher in the Dublin Technical Schools, of which he (the Lord Mayor) happened to be a Governor. Being interested, as they all were, in the advancement of technical education, he was glad to say that the Dublin schools were now in a very progressive condition, and that a tremendous impetus had been given in recent times to the cause of technical education in the city. Their schools were on the high road towards rapid development and improvement; and they expected important results in the near future. There was room for great development in technical education in Ireland; and the local authorities, who did all they could to further it, were engaged in a very patriotic work. In Dublin they had already brought together a very fine teaching staff, and Mr. Outon was one of its members whom the Committee most highly prized. They were all aware of the important position he occupied in connection with the Great Southern and Western Railway, by the Directors of which he was held in high regard.

The PRESIDENT expressed his grateful thanks to the Lord Mayor for what he had said in his regard.

A vote of thanks, carried by acclamation, was also passed to the Lord Mayor and the Municipality for the use of the Council Chamber for the purposes of the meeting.

The proceedings were then brought to a close.

LUNCHEON AND AFTERNOON TEA.

By invitation of Mr. Outon, luncheon was provided for the members at the Dolphin Hotel at one o'clock. Mr. and Mrs. Outon invited all the ladies accompanying members to travel by train from Amiens Street Station to Howth Head, where, after enjoying the splendid views of Dublin Bay, the Irish Sea, the Wicklow Mountains, and the northern coast line, afternoon tea was served—thanks being duly conveyed to host and hostess.

EXCURSION TO WICKLOW.

On Wednesday, the members and their lady friends had an excursion to County Wicklow. Leaving Harcourt Street Station at 10.15 a.m., they arrived at Bray in forty minutes, and left in drags and on cars for Greystones, where luncheon was served in the Grand Hotel. At 2.30, the party started for a drive through Daljeny, the Glen of the Downs, and the Rocky Valley to Lord Monck's entrance to the Dargle; returning by the Dargle Valley to Bray, where they had tea in the International Hotel.

SOME NOTES ON HIGH-PRESSURE LIGHTING.

By A. M'I. Cleland, Belfast.

[A Paper read before the Irish Association of Gas Managers.]

In the year 1855, Robert Wilhelm von Bunsen was busily engaged designing the details of the chemical laboratories of Heidelberg University. Among the many subjects to which he turned his attention was that of laboratory bench heating. Should it be by means of coal gas, or oil, or alcohol? All these had their disadvantages. Burners fed by vegetable or animal oils (mineral oils not being then known commercially) were apt to blacken the apparatus in a disagreeable manner. On the other hand, alcohol flames, though clean, had a comparatively low temperature.

Coal gas seemed to offer the greatest possibility of usefulness as a heating agent. Here was a medium requiring no wick; no artificial arrangement for inducing draught; and with a high calorific value. The flame, however, was inclined to be smoky; but Bunsen's genius soon devised a method of getting over this difficulty. Whether in doing so he was influenced by Davy's work (forty years previously) in connection with the miner's safety lamp, one cannot tell. In 1815, Davy brought to the notice of the Royal Society a device consisting of a piece of wire gauze held a slight distance above an orifice through which coal gas was issuing. In crossing the intervening space, the stream of gas became mixed with air, and the mixture burned quietly above the gauze, with a non-luminous, non-smoky flame. Bunsen greatly improved upon this idea, rejected the wire gauze, injected a stream of gas along an outer tube, and caused the gas to draw with it its own supply of primary air through suitable orifices in the base of the outer tube. In other words, the burner took the form we are all so familiar with to-day.

And as Bunsen devised it so it continued through many decades. It is difficult to realize where the gas industry would be to-day but for Bunsen and the burner and non-luminous flame associated with his name. In the hands of Fletcher, of Warrington, Wright, of Birmingham, and many others, the bunsen burner was applied to a multitude of heating apparatus and brought to a high state of efficiency.

But it was reserved for an Austrian investigator, Dr. Auer von Welsbach, to compel minute attention to be directed to both the burner and the flame. Welsbach mantles had not been long in use ere it was found that in order to get the best lighting value from the mantle, the latter must always be in the hottest part of the flame. This meant that either gas or air supply must be adjustable; and as it was easier to manipulate the latter than the former, the adjustable air sleeve was evolved.

Moreover, physicists had been investigating the subject of flame structure—men like Professors Smithells, Lewes, and Clowes showing what a fascinating subject it was in itself, and how little anybody really knew about it. One thing was soon noticed—viz., that the greater the aëration of the burning mixture, the greater the heat of the flame, and, of course, the better the illuminating result where incandescent mantles were being used.

This consideration gave rise to Denayrouze, with his mechanically-driven fan; Kern, with his venturi tube, inner and outer cones, and ratchet-wheel; and Bandsept, with his system of injectors. All these devices had the same object in view—to ensure a greater aëration of the mixture of gas and air before it reached the nozzle of the burner.

For various reasons, such devices, though good in themselves, did not prove popular. No burner carrying mechanically-driven parts need make any bid for public favour, (as witness the fate of the Scott-Snell lamp); so Denayrouze went down. Bandsept's intricate system of injector cones proved too susceptible to changes of pressure. The Kern burner certainly had a long run of popular favour, in spite of its high price and its exasperating habit of whistling or singing, in season and out, though mostly out. It could not, however be easily adapted as an inverted burner.

The result of all these various inventions and adaptations has been the gradual evolution of what may be regarded as a law of constants for burners constructed on the bunsen principle. It is now realized that a constant unvarying pressure of gas and a constant unvarying supply of air are both essential for the best results, whether in public or private incandescent lighting, or private or industrial incandescent heating. The great success of high-pressure incandescent gas lighting (regarding high-pressure, for the moment, as including anything between 8 inches and 80 inches) is due to the unvarying pressure of the gas, when induced by some form of mechanically-driven fan or compressor, permitting the flame to be maintained in a condition to enable its maximum heating effect to be taken full advantage of.

Further, there is a growing tendency among gas engineers to turn out gas of a constant calorific value, though not necessarily a high value; the illuminating power being regarded as of quite secondary importance. In this connection may be mentioned the recent assent of Parliament to the Wimbledon Amalgamation Act, in which an illuminating power test has been abandoned in favour of a calorific test, with appropriate penalties for non-compliance with the terms of the Act.

We are, therefore, able to formulate a short table of constants relating to incandescent gas lighting: (1) Calorific value; (2) proportion of air; (3) pressure of gas; (4) specific gravity.

It is not difficult to realize the importance of the above when we recollect the conditions governing the successful adaptation of the inverted incandescent burner—a class of burner destined to grow more and more into popular favour. Here we have two streams of gas and a flame contending from the very first with natural laws. Further, the heat of the burner itself tends to check the initial velocity of the combined stream of gas and air, by expanding the mixture, and thus throwing a "back-pressure" on both nipple and air passages. As we all know from much unpleasant experience, so delicate is this inverted flame that a drop of two or three tenths of an inch in pressure is sufficient to cause a blackening of the mantle. The reduced velocity of the stream of gas as it issues from the nipple is more than enough to upset the balance between air and gas supply.

The importance of aiming at a constant specific gravity is seen from the following table, which shows the variation in burner capacity due to change of gravity, using a constant pressure of 20-10ths of an inch.

Table I.

Capacity of	4·000	cubic feet	per hour	at	·45	specific gravity
Becomes	3·795	,,	,,	,,	·5	,, ,,
,,	3·618	,,	,,	,,	·55	,, ,,
,,	3·464	,,	,,	,,	·6	,, ,,

Of course, no gas varies from day to day to the extent of ·05 specific gravity. But when the exigencies of supply (due to change of weather, etc.) demand, say, a large addition of carburetted water gas, the consequent alteration of specific gravity is bound to tell on the efficiency of the street lighting.

Now the above remarks apply not only to bunsen flames used for incandescent lighting, but to all bunsen flames, whatsoever their use, domestic or industrial. It is, therefore, becoming almost imperative for gas manufacturers to see to it that bunsen burners are so adjusted as to give their best results at all hours of the day. The kitchen cooker, the drawing-room heater, or the inverted burner in the study, must give unvarying results; and this can only be done by striving for a uniform day and night pressure (30-10ths of an inch) at the outlet of each consumer's meter.

This will necessarily mean a return to the old domestic governor; but this return is inevitable if we are to reap the full benefit of our greater scientific knowledge of the bunsen flame and burner. Adjustable nipples and adjustable air sleeves should not be left to the manipulation of the "man in the street," however great his much vaunted intelligence may be.

But, it may be urged, all this has nothing whatever to do with high-pressure lighting. On the contrary, the writer has no hesitation in claiming that the two are intimately connected. For the term "high pressure" is after all merely relative. As will be presently shown, some of the most successful pressure plants in Belfast are working at a mere 6 inch gauge. All, however, meet the great want of a constant and unvarying pressure.

With reference to high-pressure lighting as applied to Belfast, the matter naturally falls into two groups—public lighting and private lighting.

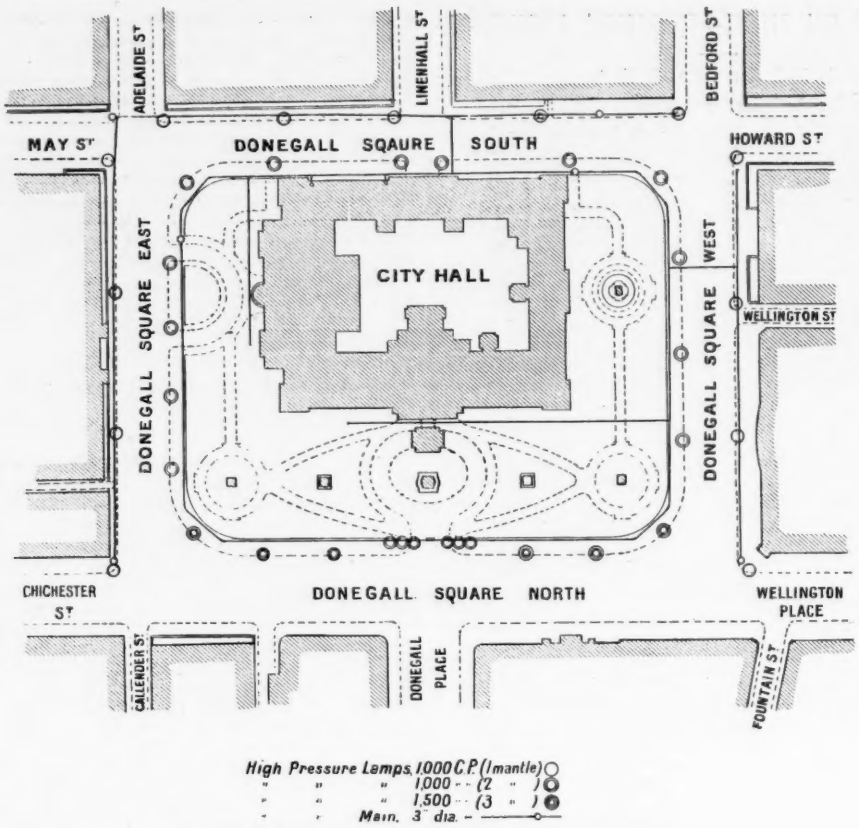
Regarding the former, the system to date, so far as the Belfast Corporation are concerned, is only applied to the lamps in the streets surrounding the City Hall in Donegall Square—a somewhat limited application. Our records for private high-pressure lighting, however, show the respectable number of over three dozen firms, who are using some one or other of the many high-pressure systems on the market, and using them to their entire satisfaction.

It will be borne in mind that local circumstances will always largely determine how far it is possible, or financially advisable, to lay down high-pressure plant and mains for the purpose of supplying private customers. At present, there seems to be a very remote possibility of any demand arising in Belfast for gas at 15 lbs. pressure. Such gas is used largely in metallurgical work, or for other industrial purpose than mere lighting. There are comparatively few such works in Belfast (the writer only knows of one); all of them being considerable distances from the gas-works. Any scheme having for its objective the supply of such works would be somewhat oo speculative to commend itself to lovers of sound finance.

Locality, again (in Belfast), will militate against an enthusiastic advocacy of a system of mains for supplying high-pressure gas for lighting mills and factories, seeing that these are very much scattered, and are to be found at all points of the compass—the nearest half-a-mile away from the works, the farthest four miles distant.

We are, however, looking forward with hopefulness to doing considerable business in what is now known as "parade lighting." When the high-pressure system around the City Hall is extended into Donegall Place and Royal Avenue, we quite expect its many advantages will impress themselves on shopkeepers to our mutual benefit. Meanwhile, a few facts regarding the lighting of Donegall Square will be of interest.

The area of streets (for which see plan) at present lighted in this manner is 20,700 square yards. The burners are fitted 16 feet from the roadway, and the lighting effect at the point of weakest illumination is 0·452 foot-candle. The lamps, 38 in number, are either of 1000 or 1500 candle power; the latter (six in all) being fitted in Donegall Square North—that is, on the side bordering the façade of the City Hall. This side has also two triple groups of 1000 candle power lamps, one on each side of the main drive. The average distance apart of the lamps on the inner footpaths is about 23 yards. On the other footpaths, the average distance is about 43 yards.



The Position of the Gas-Lamps round the City Hall at Belfast.

The gas is compressed to 54 inch pressure by means of one of the James Keith and Blackman Company's rotary compressors, electrically-driven, the motor being mounted centrally with the compressor. This apparatus is housed in a small chamber in the basement of the City Hall. The compressor-motor is in duplicate, and the meter is provided with a bye-pass; so that in the event of a breakdown in either motor or meter, matters could be adjusted in a very few moments.

The increase in pressure is accompanied by a considerable rise in temperature, due partly to friction and partly to compression. The following table shows a record of tests made on two occasions, at a point 7 feet from the outlet of the compressor and 18 inches from the outlet of the governor. But though the gas at this point never rose beyond 74·75° Fahr., the compressor cylinder was much hotter; the heat being just bearable to the open hand.

TABLE II.—*Temperature of Gas at Compressor Outlet.*

	18th April.				20th May.			Remarks.
At start	7.10 p.m.		63° F.	At start	8.25 p.m.		60·5° F.	Thermometer fitted into outlet pipe 7 feet from outlet of compressor and 18 inches from outlet of governor. Rise of temperatures.—18th April: 11° in 1 hr. 50 mins. 20th May: 14·25° in 3 hrs. 30 mins.
Minutes per degree	7.20	,,	64 ,,	Degrees per 15 minutes	8.40	,,	61·0 ,,	
	7.35	,,	65 ,,		8.55	,,	62·0 ,,	
	7.45	,,	66 ,,		9.10	,,	63·75 ,,	
	7.55	,,	67 ,,		9.25	,,	65·5 ,,	
	8.5	,,	68 ,,		9.40	,,	67·0 ,,	
	8.12	,,	69 ,,		9.55	,,	68·5 ,,	
	8.19	,,	70 ,,		10.10	,,	70·0 ,,	
	8.28	,,	71 ,,		10.25	,,	71·0 ,,	
	8.38	,,	72 ,,		10.40	,,	72·0 ,,	
	8.47	,,	73 ,,		10.55	,,	73·0 ,,	
At close	9.0	,,	74 ,,		11.10	,,	73·75 ,,	
					11.25	,,	74·0 ,,	
					11.40	,,	74·5 ,,	
				At close	11.55	,,	74·75 ,,	

The capacity of the compressor is 1000 cubic feet per hour. At present, we are working it up to 700 cubic feet per hour, so that we have still a considerable margin of safety left. The burners are rated to consume 8·33 cubic feet per hour each per 500 candle power; and the current required, under full load, is estimated at 600 watts per hour per 1000 cubic feet.

Here it may be mentioned that it is our practice to make nightly records of the readings of both gas and electric meters. We are thus enabled at the end of the month to work out the consumption per burner or motor per lighting hour. Should the consumption of gas decrease, it indicates that the nipples require a little attention; and should it increase, it points to possible leakage. We attach particular importance to this monthly checking of the consumption. That the consumption varies is clearly seen from the Table III.

The burners in use are all of the inverted type; the lanterns being fitted with either two or three of these burners, each giving 500 candle power per burner, or with one single burner of 1000 candle power. Full particulars of these are shown on the plan

TABLE III.—*Consumption in Cubic Feet per Burner per Hour.*

1911.	Aug.	Sept.	Oct.	Nov.	Dec.
—	8·45	8 18	7·85	8·29	8·51
1912.	Jan.	Feb.	March.	April.	May.
—	8·23	8·77	9·04*	8·77	8·22

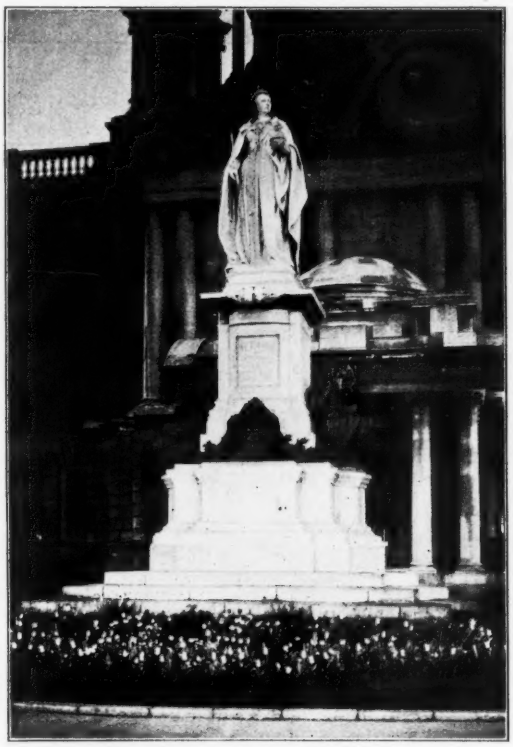
* Including gas used in testing and blowing out new mains.

of Donegall Square. The lanterns are all harp-hung, of Keith-Blackman's make, provided with their thermostat air-valves and regenerative diaphragms. The former comes gradually into action as the heat from the burner increases, allowing the necessary quantity of air to enter after the gas is ignited—thus avoiding all risk of explosion and consequent ruin of mantles. As the gas has to pass over the heated surface of the diaphragm before reaching the burner nipple, it is subjected to a very considerable regenerative action; and this has an advantageous effect on the lighting duty, the total of the latter amounting to 60 candles per cubic foot.

As to the practical lighting effect of these lamps, so far as they have been installed in Belfast, one cannot say too much in its favour. There is a steady evenness about the lighting, and a complete absence of glare, that is very refreshing after contemplating the somewhat hysteric conduct of neighbouring electric arc lamps of various kinds. Further, owing to the moderate height (16 feet) at which the burners are fitted above the pavement, one has no sensation of walking at the bottom of an immense vault or tunnel, with the lights skied up in the roof, which is the impression given when flame-arc lamps are fixed 30 feet high, or thereabouts.

The quality of the illumination is very well seen in Photos. Nos. 1 and 2. In the former, the façade of the City Hall is 126 feet distant from the lamps. The lighting of the roadway in the latter shows an absence of spottiness that is very gratifying. It should be pointed out that the white lines in this photo. are from the head lights of the tram cars.

With regard to the important question of maintenance, we find it undoubtedly high—too high to satisfy us. For this, there are several reasons. First, owing to the lamps being fitted in the very heart of the city they must always be kept up to "concert pitch," if only for the purpose of advertisement. As an advertisement, a good display of public high-pressure lighting cannot be over-rated. Secondly, it is inevitable that a certain amount of skilled labour must be given to the maintenance of such lamps. The "handy man" is here a very weak reed to lean upon. Our practice is, therefore, to let a skilled artizan keep in touch with the system, while allowing the ordinary work of lighting, cleaning, &c., to be done by a specially-trained labourer. Thirdly, any labour is naturally more costly, if carried on after ordinary working hours, which is inevitable in the case of street lighting.



No. 1.—Queen Victoria Statue outside the City Hall, Belfast.

[This and the other photographs by which the paper was illustrated were taken by Mr. R. Welch, of Belfast.]

The maintenance costs and mantle renewals are set forth in Tables IV. and V.

TABLE IV.—*Maintenance per Lamp per Month.*

1911.	Aug.	Sept.	Oct.	Nov.	Dec.
	s. d.	s. d.	s. d.	s. d.	s. d
—	8 5	6 10	6 9	5 7	4 10
1912.	Jan.	Feb.	March.	April.	May.
	s. d.	s. d.	s. d.	s. d.	s. d.
—	5 0	6 9	6 0	5 3	4 7

TABLE V.—*Mantle Renewals per Burner per Month.*

1911.	Aug.	Sept.	Oct.	Nov.	Dec.
—	2·43	1·98	1 82	2 09	1·81
1912.	Jan.	Feb.	March.	April.	May
—	2·11	1·69	1·81	1·69	1·83

At first our globe breakage was very heavy—due, we believed, to fractures caused by small jets from faulty mantles impinging upon the glass. To reduce this risk, any mantle observed to have the slightest hole in it is at once replaced by a new one. The result may mean greater mantle renewals, but undoubtedly reduces the cost of maintenance.

The current required for the motor is set forth in Table IV. The average quantity per 1000 cubic feet up till February was 1·28 units. The average at the present time, when the compressor (of 1000 cubic feet capacity) is being worked up to 700 cubic feet per hour, is 1·03 units. When the compressor is worked to its full capacity, we anticipate the current required will be 600 watts per 1000 cubic feet, costing (at present Belfast power rate) somewhat less than ¾d.

TABLE VI.—*Consumption of Gas and Electricity.*

1911.	Aug.	Sept.	Oct.	Nov.	Dec.
Gas (cubic feet)	112,900	141,100	171,600	204,500	231,000
Electricity (units)	141	184	234	261	294
Current (units) per 1000 cub. ft.	1·25	1·3	1·36	1·27	1·27
Cost (pence) per 1000 cub. ft.	1·5	1·56	1·63	1·52	1 52
1912.	Jan.	Feb.	March	April	May
Gas (cubic feet)	213,200	181,500	238,300	190,400	119,300
Electricity (units)	276	224	201	157	109
Current (units) per 1000 cub. ft.	1·29	1·23	0·85	0·82	0 91
Cost (pence) per 1000 cub. ft.	1·55	1·47	1·02	0·98	1·09

There is one danger in connection with the use of an electric motor which can only be provided against by laying on the current from two mains. This is the danger of a fault in the town cables throwing the automatic starter out of action, and so stopping the motor. This has happened once, and (one might almost say "of course") in the small hours of the morning. In any further extension of the scheme of high-pressure, we shall probably put down gas-engines, graduated in size according to the demand.

PRIVATE AND SEMI-PRIVATE HIGH-PRESSURE LIGHTING.

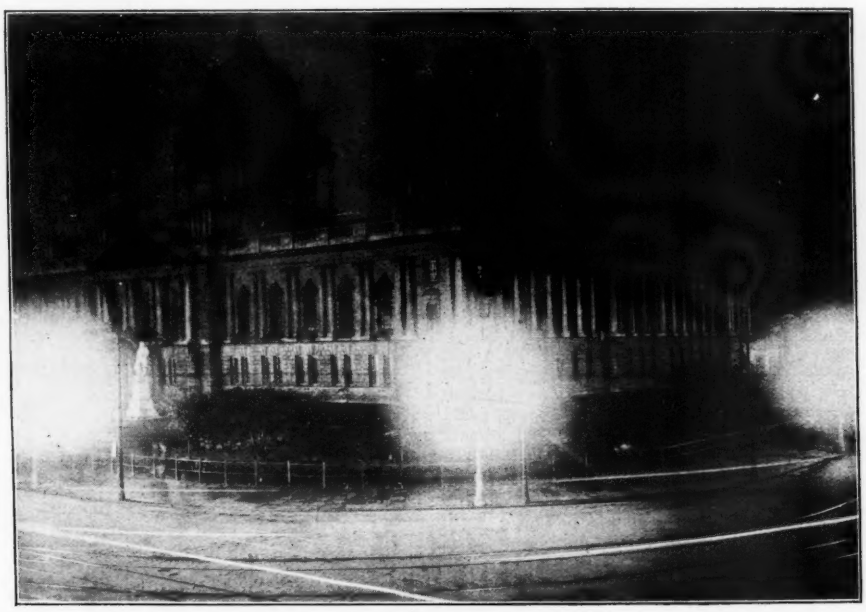
Turning now to private and semi-public high-pressure lighting, the following list shows how very varied are the industries to which this style of lighting has been applied.

TABLE VII.—*List of Factories, &c., using High-Pressure Lighting.*

Manufactories.	Number of Installations.
Weaving	10
Handkerchief	7
Engineers	6
Public institutions	2
Public works	4
Boots and shoes	1
Confectionery and preserves	1
Soap and candles	1
Printers and lithographers	2
Shirts and collars	2
Blouse makers	2
Sewing cotton	1
Hemstitchers	1

Most of the compressors are actuated by belt-drives taken off the factory or workshop shafting; some are driven by gas-engines; others by electric motors; a few by pressure from the town water-mains. The machines give little or no trouble. So far as the writer is aware, high-pressure gas when once installed is always retained.

As we have had several collapsed meters brought into store, we



No. 2.—Donegall Square North, Belfast.

TABLE VIII.

Name.	Room.	Size in Feet.	Height in Feet.	Area in Square Feet.	No. of Lights.	Total Candle Power.	Illumination at Working Level. Max.	Illumination at Working Level. Min.	System.	Consumption per Burner.
Swanston and Bones . . .	Laundry	109 × 40	Open roof	4360	24	3600	7·32	5·06	Keith-Blackman	2½ cubic feet
,, ,, . . .	Stitching	78 × 36	11 ft. 4 in.	2808	26	3900	7·90	5·20	,,	,, ,, ,,
Belfast Corporation . . .	Tinsmiths	103 × 31	Open roof	3193	34	4080	12·40	8·86	,,	2 ,, ,,
W. W. Cleland and Co. . .	Fancy box	120 × 24	10 ft. 3 in.	2880	19	1900	11·76	4·44	Selas	2 ,, ,,
,, ,, ,, . .	Machine box	62 × 52	10 ft. 6 in.	3224	14	1400	11·76	..	,,	2 ,, ,,
A. Finlay and Co.. . . .	Candle loft	100 × 21	Open roof	2100	12	1200	7·11	4·88	,,	2 ,, ,,

have had to warn consumers against making the elementary mistake of starting the compressor before turning on the meter tap; or turning off the tap before stopping the compressor. The warning takes the form of a special card bearing the following terse notice:

Do NOT start the compressor before turning on the tap of the meter.

Do NOT turn off the meter tap before stopping the compressor.

We also impress upon those friends who have pinned their faith upon gas-air compressors, that the air must be strictly confined to the outlet side of the meter. On no account must air be forced into the town mains. This was allowed to happen on one occasion, and gave us some hours of great uneasiness and anxiety.

In order to illustrate the excellent lighting effects obtained by high-pressure gas, a number of photographs have been taken of various Belfast factories and workshops.* In addition, Table VIII. contains particulars of the rooms or buildings dealt with which it is hoped may be of interest to the members.

With two exceptions (those of the Queen Victoria statue in front of the City Hall and the view of Donegall Square), every photograph was taken under the personal supervision of the writer. He can therefore testify that they are all genuine gas-light productions, printed directly from untouched negatives. As the lighting season was nearly over when a commencement was made to gather the material for this paper, the lighting in the various factories selected was not at its best. Factory owners were naturally not willing to remantle their burners simply for the purpose of producing a good photographic effect. Despite this drawback, however, some of the photographs show results which approximate very closely to average daylight effects.

As far as possible, the factories selected were those of typical Belfast industries. In all, good lighting is a vital necessity. In most, rapidly moving machinery is constantly in use, and the majority of the workers are women or girls. The aim in each photograph was to secure a record of the lighting effect on that part of the premises (bench, table, machine, roadway, &c.), where the best illumination was required. Everything else was neglected and left out of account.

Dealing with some of the photographs more particularly, it may be mentioned that in Swanston and Bones laundry, the lighting leaves very little to be desired. In fact, it might seem to be almost over-lighted, considering the class of work done in this particular department. At the examining table, however, a specially strong light is needed. In the firm's stitching room, the burners are arranged centrally with the passage ways, which is perhaps a mistake; and though the maximum lighting effect at the bench level is 7·9 foot-candles, this is not quite the effect on the machines. At the same time, there is no sensible diminution of lighting effect on any part of the benches. It might, however, have been better to fix the lights 12 inches lower, seeing that the machines make 2000 stitches per minute. This reduction in height would have given a maximum lighting effect of 10·7 foot-candles—none too much for such rapidly revolving machines.

With regard to the view of the Belfast Corporation tinsmith shop [see p. 187], we have here an excellent example of what such lighting ought to be. The walls are coloured white—being lime-washed every year. The lighting is strictly point lighting, every man having one light for his portion (8 feet) of bench. White enamelled reflectors, with green upper surfaces are used, and the effect on the benches is so good that the men have no difficulty whatever in working in either tin, copper, or black iron.

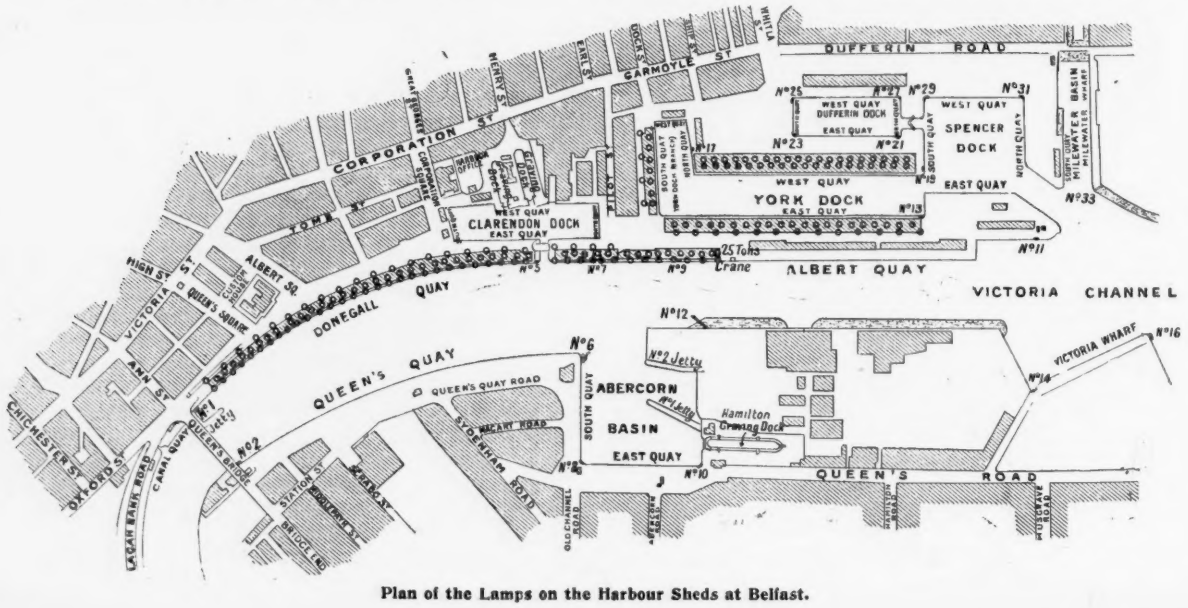
The ridiculously small size of the compressor required to supply this room and the adjacent brassfinishers' shop is seen in one of the photographs. The compressor is of a maximum capacity of 200 cubic feet per hour, at present being worked at 120 cubic feet per hour. It is belt-driven from pulleys connected to the general shafting of the workshops. The same pulleys also drive the fan for supplying air to the tinsmiths' blow-pipes and the meter testing holders.

The view of W. W. Cleland and Co.'s fancy-box room [see p. 187] is also an excellent example of "point" lighting. Here, though the class of work is uniform, the colours are of all shades. Good lighting is therefore an essential. This firm's machine box room is also point lighted (one burner over each machine), though the scheme is very irregular. A good deal of its effect is lost owing to the walls being hidden by stock. The open roof is also a disadvantage.

A few remarks may be made with reference to the lighting of the Harbour quays and sheds on the Antrim side of the river. This is entirely done by 9 inch pressure gas; the pressure being raised by water motors, actuated by the town mains. The length of quay and road lighting is 2570 yards; and of shed lighting 2585 yards. The lanterns are of either 300 or 450 candle power, each containing two upright burners.

Photo. No. 3 shows a length of quay and shed respectively, lighted by 300 candle power lanterns. The burners of the quay lanterns are fitted 19 feet, and the burners of the shed lanterns 15 ft. 7 in. above ground level. The illumination in foot-candles is, approximately: Quay, 0·837 maximum, 0·052 minimum; shed, 1·247 maximum, 0·06 minimum. When loading or unloading vessels, the lighting of the quays is assisted by the ships' lighting. It is gratifying to know that merchants, stevedores, carters, and dockers all unite in a unanimous appreciation of the excellence of the present lighting of the sheds and quays. If the Harbour Commissioners could be persuaded to change over to 54-inch pressure and inverted burners, the results, of course, would be even more satisfactory. One benefit would be the elimination of the heavy shadows cast by the present type of lantern.

* Four of these are reproduced on p. 187.—ED. J.G.L.



Plan of the Lamps on the Harbour Sheds at Belfast.

Swanston and Bone's Stitching Room.

Cleland and Co.'s Fancy-Box Room.

Finlay and Co.'s Soap-Shed.

Belfast Corporation Tinsmiths' Shop.

BELFAST WORKSHOPS AND FACTORIES LIGHTED BY HIGH-PRESSURE INCANDESCENT GASLIGHT.

No. 3.—The Lighting of Donegall Quay, Belfast.

The Great Northern Railway Company's station is also lighted by 9-inch gas, the pressure being raised by water power. The lanterns are fitted with duplex upright burners of 150 candle power each. They are suspended 13 ft. 6 in. above the platform level; the average maximum and minimum lighting effect being 1·8 and 0·962 foot-candle respectively. The result is excellent.

Two views of the Wolfhill Spinning Company's premises are put in as examples of the application of high-pressure gas for lighting large and complicated rapidly moving machinery. One photograph was taken when work was in full swing; the second during a temporary stoppage of the particular machine. A flood of light is thrown into every part of the machine and all its details.

Lastly, there is exhibited a view of a ward of the Infirmary of the Union Workhouse, in order to show how great is the flexibility of the application of high-pressure lighting. The light in the Infirmary is particularly suited to the patients, and is greatly liked by them, owing to its steadiness and freedom from glare.

In conclusion, whether the application of high-pressure gas (or "re-inforced" pressure as some prefer to call it) for illuminating purposes has reached its limit is a question that future practice only will determine. It is significant that, so far as the writer is aware, no attempt has been made to use pressures greater than 60 inches to 80 inches of water. From this, it may be judged that the fabric of the mantle will not resist a flame induced by any greater pressure than the above, except at the cost of an enormous bill for mantle maintenance. Of course, one is well aware that there is no pressure in the flame itself; but there is undoubtedly a certain "cutting" action which is very detrimental to high-pressure mantles.

Further, it may very properly be questioned whether 60 candles per cubic foot may not be purchased at too high a price. With lanterns of the high-class type now on the market, fitted with semi-regenerative appliances, and burners giving an effective duty of from 40 to 43 candles per cubic foot, one may very well pause. Is the balance of 17 candles in favour of high-pressure gas worth all the extra capital outlay involved, for mains, motors, &c., and the extra running costs for supervision?

Use of High-Pressure Gas in Textile Heating.

It will be borne in mind that this short paper deals only with the applicability of high-pressure gas to purposes of illumination. The governing conditions are entirely different when this gas is applied to textile heating and other purposes. But as comparatively few gas concerns (at least in Ireland) could look forward to doing much business in high-pressure gas except for lighting, it might be as well to proceed cautiously.

We need not fear competition, whether with ordinary or induced pressure gas. This is clearly set out in the following table, where gas has been taken at the local net price of 1s. 9½d. per 1000 cubic feet, and compared with lighting current rates varying from 2d. to 4d. per unit. The watts per candle power for the various types of lamps selected have been taken from the makers' lists; so we may presume they are not too modest, especially when compared with the figures given in Mr. Jacques Abady's recent paper on "Light and Competition."

From Table IX. it will be seen that even a duty of 30 candles per cubic foot, with gas at 1s. 9½d. per 1000 cubic feet, is cheaper per 1000 lighting hours than a mercury lamp (the most economical electric lamp at present on the market) supplied with current at 2d. per unit.

Finally, attention may be drawn to three photographs of the same length of working bench illuminated by three systems of

Table IX.

Candles per Ft.	Cost per 1000 Candle-Hours. Gas per 1000.	Price per Unit in Pence.					Type of Lamp.	Watts per C.P.
	1/9½.	2.	2½.	3.	3½.	4.		
60 (H.P.) .	·358	·8	1·0	1·2	1·4	1·6	Mercury vapour .	0·4
55 ,, .	·391	1·0	1·25	1·5	1·75	2·0	Flame arc . . .	0·5
50 ,, .	·43	1·5	1·87	2·25	2·62	3 0	Enclosed arc . .	0·75
45 ,, .	·477	2·22	2·77	3·33	3 88	4·44	One-watt met fil .	1·11
40 (L.P.) .	·537	2·34	2·92	3·51	4·09	4·68	Osram ,, ,, .	1·17
35 ,, .	·614	2·5	3·12	3·75	4·37	5·0	Mazda ,, ,, .	1·25
30 ,, .	·716	2·72	3·4	4·08	4·76	5·44	Ediswan ,, ,, .	1·36

lighting: Flat-flame; ordinary inverted; high-pressure inverted. The burners in each case were in exactly the same positions. The plates were all equally exposed and developed in the same way. No globes or reflectors were used with the flat-flame or ordinary inverted burners, but the high-pressure inverted burners were fitted with reflectors. The burners were 8 feet apart, and 2 ft. 9 in. above the bench. All other sources of light were excluded.

As one would naturally expect, the illumination by the flat flames was very poor. But it is not easy to tell the difference between the lighting of the bench illuminated by the inverted burners supplied with gas at 34-10ths of an inch and those supplied with gas at 54 inches. Yet the difference in candle power is considerable, as the following table shows:

Table X.

Flat-flame	9 × 2 = 18	cubic feet ×	3 =	54 candles.
Ordinary inverted. . . .	3½ × 2 = 7	,,	× 25 = 175	,,
High-pressure inverted . .	2 × 2 = 4	,,	× 60 = 240	,,

Here the entire advantage, judging by the photographic record, lies in the economy of consumption. This has to be balanced against the capital outlay involved in the instalment of high-pressure plant.

Whichever system is adopted, ordinary pressure or high-pressure, we stand to win, so long as competition is fair. Light for light, gas leads the van, and may do so fearlessly, though of course keeping a sharp eye on all rivals.

Discussion.

The President (Mr. C. B. Outon) asked for criticism of the paper. No one rising, he said he supposed the diffidence shown by members was due to the fact that, so far as the Irish practice was concerned, the author was a little in advance of the times, and very few of them had had the opportunity of learning anything about high-pressure lighting in their respective towns. He ventured to think that the paper would be well read and pondered over for each one's future guidance; and, personally, he felt a deep debt of gratitude to Mr. Cleland for the great care and attention he must have given to the preparation of his subject. It appeared to his mind to have been treated in a most exhaustive manner, and would form a very interesting study for their future guidance and profit. Indeed, he regarded it as one of the most notable papers brought before the Association in his recollection. So far as he could make out, the author had had the benefit of the experience of two distinct systems of high pressure, in one of which he mentioned the compression of gas only as represented

by the Keith system, and in the other the compression of both gas and air. Of course, as they all knew, in the case of the compression of gas only, the whole of the air required for combustion was infused at the nipple; while in the Selas system, the mixture of gas and air required a smaller quantity of infused air at that point. He would be glad to have an expression of opinion from Mr. Cleland as to the relative merits of the two systems, as both claimed equal duties—50 to 55 candles per cubic foot—from 500-candle power and upwards. He should also like to ask whether there was any greater likelihood in the high-pressure system of the small hole of the nipple becoming clogged or corroded, compared with the larger hole that was used in the gas-air system of the lower pressure. Was any precaution taken in the Selas system to filter the air prior to its admission for compression, in order to prevent clogging the nipple with particles of dust? There was yet a third method on the market which was not mentioned in the paper—viz., a system of compressing air only, and infusing the gas at low pressure.* The other system to which he had referred—viz., the compressed air one—had very recently been introduced into Dublin; and it was his privilege on the previous Friday to inspect a small installation of it. He was particularly impressed with one paragraph in the paper wherein the author contrasted the gas with its duty taken at its worst with electric light taken at its best, and under the most modern conditions—showing that, light for light, there was a very large balance, in point of economy, in favour of gas. He regarded this as one of the most important paragraphs in the paper. On behalf of the Association, as well as on his own, he tendered their grateful thanks to the author for his kindness in providing them with such interesting matter.

Mr. W. H. Roberts (Newtownards) said he should like, by way of criticism, to ask Mr. Cleland a question with regard to one small item, where he claimed that they could get, with a low-pressure system, within 17 per cent. of what they could get by a high-pressure one. Was he right in taking it that this was with the self-intensified burner? Assuming that this had been as long on the market as the ordinary burner, his experience was that the self-intensified burner had never come into proper use with them in Ireland. There must be some drawback that prevented its being adopted as a successful burner; and therefore he thought they were more likely to take the value of the high-pressure gas as about 60-candle power, against about 30-candle power for the low-pressure gas. They were inclined to look upon this as the correct basis; and Mr. Cleland might say whether or not this was the case. He wished further to say that some time ago they had adopted high pressure in Newtownards; and it was now available over about two-thirds of the town. They had also extended the system so as to enable the private consumer to use high-pressure gas direct from the mains. At present they had a number of private consumers, including a large and a small factory and a Technical School. To give the members an idea of the success of it, he might mention that his Committtee had recently to consider the question of supplying high-pressure gas to all the banks. The mill-owners were also pressing for it; and the only thing they could do was to promise to supply compressors free. But they were charging about 2d. per 1000 cubic feet extra for the gas. This had only been recently arranged for, and already they had several applications. Another point with regard to the practical use of high-pressure gas was in connection with the Technical School. Shortly after this school was lit up with it, there was another school about to be equipped in County Armagh; and the Committee sent the plans up to Dublin to have them passed. Before they were approved, the authorities wrote to the Technical Committee asking them what sort of light they were putting in. They replied that they were using the ordinary incandescent burners. The plans were then sent back with an intimation that if the Committee did not get the modern system the plans would not be passed. The problem then arose: What was the modern system? And it was then learnt that the Newtownards system was the only one that would be adopted. One of the advantages of it was that they were able to have a 1500-candle power lamp with a single burner—thus doing away with the complicated shadows that would have been obtained by three or four mantles distributed through the room. He quite agreed with what Mr. Cleland had said, that high-pressure gas had a future before it, and that it was well worth taking up.

Mr. Cleland, in reply, said one of the remarks of Mr. Roberts bore out, to a large extent, one of his (the speaker's) contentions—viz., that the application of high-pressure lighting by mains must, of necessity, be extremely limited. If Mr. Roberts in his area was supplying compressors on hire rather than going to the expense of laying down high-pressure plant and mains, it simply showed that, in a place like Belfast, where their largest business was done in separate units—in factories or engineering works—it would be simply suicidal for the Corporation to spend money laying down mains and plant that would be used for lighting in the winter time only. It would be equally bad policy to hire-out motors, as was done in Newtownards. The plant they had at present for lighting the 38 lamps had cost them for mains and motors, exclusive of lamps and fittings, upwards of £300, which, worked out per capital cost per lamp, was rather serious. Mr. Roberts had referred to what he (Mr. Cleland) would call a high-grade low-pressure lamp giving a light of 43-candle power. The difference between this and a 60-candle power high-pressure lamp was 17 candles, but not 17 per cent. Was it worth while, for the sake of the additional 17-candle power, and bearing in mind all the money involved in capital expense, to go to the trouble of putting down special plant and mains? With regard to the compressed-air system, he had no personal knowledge of it. But it had been considered; and the point, to his mind, that militated against its use was that they did not secure the very thing required with compressed air—viz., a constant pressure of gas—and, as the hours of lighting varied, the capacity of the burner per hour would also vary, while the supply of air would be absolutely constant. In reply to the President's observations, he might say that in Belfast high-pressure lighting was used in spinning-rooms, where the quantity of dust was enormous. The air was filtered where gas was mixed with air; but, in spite of this, the lamps generally required cleaning periodically, no matter how the dust might be provided against. With regard to the President's first question, he believed he (Mr. Cleland) was asked to give an opinion as to the relative merits of the various systems. They recommended both; but his private predilection was for the one he had described, though he admitted that both systems were good. The one he favoured did, in his belief, give a little better light per cubic foot of gas. So far as he could judge, 60 candles per cubic foot, with gas at 54 inches pressure, was nearer the mark than any power obtained from gas mixed with air.

* The President mentioned, for the benefit of his country colleagues, that there was on view outside the Junior Army and Navy Stores, in D'Olier Street, an excellent installation of the Keith high-pressure system that would be well worth their inspection before they returned home. Also that outside the Alliance and Dublin Gas Company's show-rooms, in Grafton Street, they would find two smaller and equally effective examples. He added that he had not yet seen the Selas system in Dublin; but he had recently been informed that there was a new and large installation that had been erected in Jacob's biscuit factory, and possibly some of them might be tempted to go and view it.

GERMAN GAS AND WATER ASSOCIATION.

Reports of the Technical Committees.

[See also *ante*, pp. 32 and 40.]

HEATING COMMITTEE.

The report of this Committee states that in last year's report it was pointed out that, of the questions with which they are concerned, the use of gas for heating and cooking can in future be more satisfactorily dealt with by the Central Gas Publicity Organization, and tests of heating and cooking apparatus can be best carried out at the experimental works of the Association at Carlsruhe. These two bodies are in a position to take over the questions with which the Committee are directly concerned at the present time; and the Committee therefore propose to dissolve—merely suggesting that, if fresh questions arise requiring a separate Committee to deal with them, they can be reconstituted. The Committee have been in existence for 28 years, and their increasing activity up to the year 1909 indicates that it is not owing to any dearth of material that they seek dissolution, but only because the Central Publicity Organization and the Experimental Works are better placed to deal with problems as they may arise. Moreover, the proper investigation of questions which come before the Committee makes an unreasonable claim on the time and attention of the members, having regard to their professional engagements.

Gas-Firing for Closed Stoves.

Questions which have come before the Committee during the past year include the relationship between the gas heating industry and the pottery trade. It has been proposed that the two interests should agree to a standard for the tiling of the bodies of gas-heated stoves. The makers of gas-stoves have endeavoured to ascertain what form of tiled casings gives the best heating effect with gas. The pottery trade has now shown a disposition to fall in with recent progress in methods of heating; and since the stove with a large tiled body appeals to wide circles of people (on the Continent), it appears to be in the interests of the gas industry to work amicably with the pottery trade in this matter. While the chief advantages of a gas-fire are the rapid heating and the immediate transference of heat to the room, and while these advantages are nullified in the stove with tiled casing, there appear to be cases in which the public liking for the latter may be gratified, by adapting it for gas firing. The convenience of gas as a fuel is thereby obtained without departing from the traditional pattern of stove in German dwelling-houses.

The Committtee have also been in communication with the pottery industry with reference to the use of coke as a fuel in tiled stoves. The competition between the gas-cooker and the coal-range has been keener than hitherto. It is pointed out that the labour of stoking a coal-fire interferes with the proper pursuit of the art of cooking. The combined coal and gas range is, in the opinion of the Committee, a compromise which is worthless. But it is admitted that it has been introduced in considerable numbers, and that its manufacture is encouraged by the stove industry. There are many people who do not wish, especially in winter, to dispense with the coal-range, and yet desire to avail themselves also of the advantages of gas cooking. The Committee think that the gas-stove makers and the Association's experimental works

may profitably turn their attention to the question of the best type of gas-heating attachments for coal ranges.

Increased Pressure.

A question which has been brought before the Committee during the past year is whether it would not be desirable to increase the pressure at which gas is distributed—say, from 4 to 8 inches of water—with the object of securing a higher lighting duty and a higher heating duty in domestic and industrial gas-burners. The advantages claimed for increased pressure are a better lighting power and a better lighting efficiency, shorter and sharper heating flames with a better heating efficiency, more rapid boiling, greater range of applicability of gas in industry, less risk of flames striking-back, and less trouble from narrow service pipes, rust, condensation, naphthalene, fluctuations of pressure, &c. The disadvantages are that a greater loss of gas may be incurred and the burners must in many cases be altered. Their alteration may be undertaken at once or gradually, according as the increased pressure is introduced suddenly or by degrees.

One member of the Committee undertook experiments on the efficiency of lighting and heating burners at different pressures. His results showed that with incandescent burners which had means for the exact adjustment of the air as well as the gas supply, the candles obtainable per cubic foot of gas consumed were, *ceteris paribus*, practically the same at 4 inches pressure and at 8 inches. Burners, in which the gas or air supply could not be regulated properly or at all, gave a considerably lower duty at the higher pressure. In fact, many burners, both upright and inverted, failed completely at 8 inches pressure. The regulation is more difficult to effect properly as the pressure is increased, and with bad regulation there is much noise. A shorter life of the mantles is also indicated. The same results were obtained with the heating-burners. When the nipples were set to give the same consumption per hour at the different pressures, the same quantity of gas was consumed in all cases in boiling a given volume of water. The efficiency of gas-cookers also was not increased by a higher pressure. At 4 inches pressure, there was a saving in time of 6 per cent., and at 8 inches pressure a saving of 11 per cent. as compared with the time required for cooking at 18-10ths pressure. If, however, the consumption is not regulated to the same rate at different pressures, a very considerable saving of time is effected by the higher pressure. Though at a pressure of 4 inches the saving of time is about 34 per cent., and at 8 inches about 44 per cent., as compared with the time at 18-10ths pressure, the efficiency of the cooker diminishes considerably, as at 4 inches pressure about 16 per cent. and at 8 inches pressure 40 per cent. more gas is consumed in boiling the same quantity of water. The high-pressure apparatus used industrially at a gas pressure of about 4 inches of mercury depends for its good results on the high pressure; but a diminution of the pressure to 4 inches or 8 inches of water will not in most cases give the desired effect. The same views have reached the Committee from other sources also. Thus, while no considerable advantages are to be anticipated from an increase of the pressure of gas to 8 inches, a number of disadvantages, such as the diminished effective capacity of the gasholder and the smaller margin of safety of the water seals, are incurred. The question of an increase of pressure must not, however, be regarded as settled. One member of the Committee expresses himself strongly in favour of a considerably increased distributing pressure, which he believes would bring as great advantage to the gas industry as the increase in voltage has proved in the distribution and use of electrical energy. This view is, however, taken largely from considerations of the advantages of distributing gas to greater distances.

INSTRUCTIONAL AND EXPERIMENTAL GAS-WORKS.

The Committee charged with the administration of the Instructional and Experimental Gas-Works of the Association at Carlsruhe report that the works have had a busy year, and that the financial results of the working must be considered satisfactory.

Coal Tests.

The systematic examination of gas coals has been continued, especially in regard to Silesian coals, of which a representative number had not previously been examined. The number of distinctive descriptions of coal which have now been examined at the works is about 100. The greater number of these are recognized gas coals in general use. Some other coals, however, were examined with a view to seeing whether they might be used for gas making. In most cases the answer has been in the negative, either because the coke obtained was unsaleable or because the gas was deficient in calorific power or too rich in sulphur or carbonic acid. Since the demand for coal for gas making is continually increasing, and the price of recognized gas coals shows a rising tendency, the efforts to find other coals suitable for gas making will be continued—it is hoped, with good results.

In consequence of a notice issued at the end of last year to contributors to the experimental works, applications were received from a number of gas-works for detailed reports on various descriptions of coals which had been examined at the experimental works. In response, 234 reports were sent out, of which 116 referred to Westphalian and 33 to English coals. The report gives a complete list of the coals so far examined at the works and states that the works will be pleased to send detailed reports on these coals to gas-works for a nominal sum to repay clerical expenses. The list of English coals is the same as that given in the "JOURNAL" last year [Vol. CXV., p. 160], with the addition of Thornley.

In order to make the results of the coal tests more generally accessible, it is intended to publish a condensed statement of all the numerical results, together with a short introduction on the experimental conditions and the method of conducting the trials. The publication will be issued as soon as possible, and will cover all the gas coals examined at the experimental works. In addition to the general examinations, an attempt has been made to answer certain special questions. Among these questions may be named the distribution of the different elementary constituents of the coal among the solid, liquid, and gaseous products of its distillation. The distribution of the nitrogen and the sulphur have been dealt with in particular, and the results will be published in detail later. In regard to the distribution of nitrogen, some results have been reported in 1910 [See "JOURNAL," Vol. CX., p. 957]. As an example of the distribution of sulphur in the carbonization of coal, the results of two investigations are quoted. These refer to a Saar coal, (Rheden) containing 0·80 per cent. of sulphur, and English Thornley containing 1·71 per cent. of sulphur. The total sulphur of the coal was distributed in the products as shown in Table I.

TABLE I.—*Distribution of Total Sulphur among the Products of Distillation.*

Description of Coal.	Rheden.	Thornley.
Coke . . . . . per cent.	60·4	73·7
Tar . . . . . ,, ,,	2·4	2·2
Liquor . . . . . ,, ,,	6·5	0·5
Washer water . . . . . ,, ,,	1·4	1·5
Purifying material . . . . ,, ,,	28·3	18·2
Purified gas . . . . . ,, ,,	1·5	2·6
Total	100·5	98·7

Effect of Storage on Coal.

Investigations have been made on the effects of prolonged storage on an unbroken gas coal. The coal was examined when fresh and again after storage for 912 days (2½ years) in the open. The results are shown in Table II.

TABLE II.—*Effect on Gas Coal of Storage in the Open for Two-and-a-Half Years.*

Coal.	Fresh.	Stored.
Temperature of setting, degs. Fahr.	2138	2129
Period of carbonization, hours	4½	4½
Gas made per ton of true coal, cubic feet at 60° Fahr. 30 in., and saturated	13,127	13,762
Gross calorific power, B.Th.U. per cubic foot at 60° Fahr. 30 in., and saturated	602	560
Calorific valuation figure, B.Th.U. per ton . . .	7,902,454	7,706,720
Specific gravity of gas	0·431	0·421
Ammonia, per cent. by weight of true coal . . .	0·259	0·2945
Sulphur in purified gas, grains per 100 cubic feet .	8·78	10·58
Coke, per cent. by weight of true coal	66·0	67·0

The coal had not changed appreciably in chemical composition or calorific power by storage, and nearly the same calorific valuation figure was obtained on distillation. On the other hand, the stored coal afforded more gas of lower calorific power than the fresh coal, and the coke had fallen off in quality. It is observed that it will be interesting to make similar investigations on a number of coals (since different descriptions may be expected to behave differently in this respect), and also on various sizes of coal.

The investigations made for gas-works and firms were more numerous than in the previous year. They included 54 samples of coal, 37 of coke, 21 of spent oxide, 15 of tar, &c., and 5 of gas liquor. There were also tested twelve burners and lamps; and three series of investigations on mantles were made.

Destruction of Fire-Brick Material.

A case of the destruction of the fire-brick material of a large carbonizing chamber was investigated. It was suspected that, as the coal carbonized contained an exceptionally large proportion of common salt, the alkali in the brick had been increased, and thereby the melting point and refractoriness of the material had been lowered. Careful analyses of the sound and attacked material showed, however, very little difference in the proportion of alkali, and there was very little difference in the melting point of the brick. Consequently, other causes of the destruction must be sought. A crystalline mass which deposited in large scales in a tubular condenser proved on examination to be am monium bicarbonate slightly contaminated with tar.

Effect of Escaping Gas on Asphalt Pavement.

The effect of escaping gas on asphalt street paving was investigated by experiments on the action of coal gas on samples of asphalt. Only a small surface action took place after a long time, and no appreciable change of the hardness of the paving could be detected. Some samples of soil which were suspected of having caused corrosion of wrought-iron pipes were examined; but the analysis did not disclose anything suspicious in them, except in one case, evidence of a leakage of gas. Samples of

thick, tarry material taken from the syphon-pots of gas-mains were examined and found to contain as a rule 60 to 70 per cent. of pitch derived from the pitch-compound with which the interior of the mains had been coated, and which had been removed therefrom by the light oils condensed from the gas. Table III. shows the results of the analyses of two samples of condensed liquid containing this asphaltic coating of mains in solution and two normal samples of condensed liquid.

TABLE III.—*Composition of the Condensed Liquid from Syphon Pots.*

Condensed Liquid.	Containing Pitch Dissolved from the Coating of the Mains.		Of Normal Character.	
Light oil . . . . . per cent.	15·4	6·1	47·2	35·4
Naphthalene . . . . . ,, ,,	5·0	..	16·1	20·2
Heavy oil . . . . . ,, ,,	3·6	..	4·8	
Anthracene oil . . . . . ,, ,,	6·7	..	25·9	36·9
Pitch, free from carbon . ,, ,,	61·4	69·1		
Free carbon . . . . . ,, ,,	7·9	20·2	0·2	..
Gaseous products . . ,, ,,	..	4·6	5·8	7·5
Nature	Viscous		Fluid	

Tars, Automatic Lighting, Burner Regulators, Flue-Gas Analysis, &c.

A number of samples of tar from different descriptions of settings were examined in regard to their applicability as fuel in Diesel engines. An apparatus for testing the extent of revivification of oxide was found on examination to be of practical utility. Two types of pressure-wave distance lighters were examined. One worked satisfactorily with an increase of pressure of 27 m.m. (1·06 inch), and the other after an increase of 22 m.m. (0·86 inch). A number of burner regulators are under examination; and the results will be published at the end of the work. They are so far satisfactory that, with an increase of pressure of 40 m.m. (16-10ths) the consumption remains constant within 3 per cent., whereas without the regulator it rises by 40 per cent. A number of appliances of different types for the automatic analysis of flue gases were investigated—first by trial on synthetic gas mixtures of exactly known composition, and then on the settings of the experimental works. The results obtained with five forms of apparatus are shown in Table IV.

TABLE IV.—*Comparative Tests of Automatic Flue-Gas Testers.*

Type of Apparatus.	Percentage Deviations from the Mean Hourly Values of the Gas Examined.	Percentage Deviations from the Actual Composition of the Gas Examined.	Water Consumption of Apparatus, Gallons per Hour.
"Ados," by the Ados Company, of Aix-la-Chapelle	0·06 to 0·28	0·009 to 0·16	10·3
"Autolysator," by Dr. Strache, of Vienna	0·14 ,, 0 51	0·1 ,, 1·3*	39·6
"Eckardt," of J. C. Eckardt, of Stuttgart	0·19 ,, 0·84	0·06 ,, 1·32	6 6
"Oekonograph," of the General Furnace Company, of Berlin .	0·14 ,, 0·99	0·04 ,, 0·80	3·3
"Pintsch," of Julius Pintsch and Co., of Berlin	0·08 ,, 0·76	0·14 ,, 1·07	8·8

* After correction of the scale.

The cost of the absorbent consumed is approximately the same with all the types; but with the "Autolyzator" there is also the cost of drying the gas. The results of the tests show that the various forms of apparatus are, generally speaking, satisfactory, and that perfectly practicable apparatus may be constructed on very different lines. It is intended later to publish fuller details of these investigations.

Gas-Cooker Efficiency.

The efficiency of gas-cookers has been the subject of much discussion, and the experimental works have undertaken a series of investigations of different types of cookers. The Gas Heating Committee of the Swiss Association of Gas and Water Engineers has commissioned Dr. Ott, of Zürich, to undertake similar investigations. The Committee have been in communication with him; and it is hoped to settle the basis of the investigations. The testing of actual apparatus will then be proceeded with.

Retort-Settings.

Investigations on retort-settings have been carried out by the staff of the experimental works at the works of the Imperial Continental Gas Association in the Gitschinerstrasse in Berlin, in Schöneberg, and Hanover; also at the Hanau Corporation Gas-Works, on the new Ries carbonizing chambers there, and at the Mannheim Corporation Gas-Works, on the new bench of vertical retorts. The manner in which these investigations have been carried out is summarized briefly in an appendix (*vide infra*).

Another appendix to the report embodies the results of the experience of the experimental works in the testing of station gas-meters.

The statement of accounts of the experimental works shows that a profit of about £60 has been made, which has been placed to the reserve fund. The contributions to the support of the works, which are included in the account, amount to about £725. A number of pupils have been engaged at the experimental works during the year, and 34 gas engineers attended the course of instruction which was given in the spring.

Appendices.

EFFICIENCY TRIALS OF CARBONIZING SETTINGS.

The experience which the experimental works has gained in making efficiency trials of retort-settings has led to the adoption of the following system of carrying out the trials. The important points to be established are: (1) The quantity of coal carbonized. (2) The yield of gas. (3) The quality of the gas. (4) The fuel consumption. (5) The yield of coke. Further, it must be settled, with a view to getting proper results for the foregoing, what should be: (6) The duration of the trial and the preparatory period. (7) The temperature of the setting and the general conditions of heating of it. (8) Precautions for ensuring the genuineness of the trial.

(1) *Coal Used.*—For efficiency trials a particular coal of definite origin must be used. If mixtures are carbonized, the exact proportions of the component coals must be known. The coals should, wherever possible, be carbonized from the waggons just as received; but if taken from the store, they must be weighed in railway waggons or otherwise in large quantities, and not in small portions. The weighing machine used must be officially certified, and it should respond readily to small differences. Automatic weighing machines must be used with caution, and the recording apparatus carefully and constantly checked. Conveyor weighing machines, which show automatically the load on a chain conveyor, should only be used as a guide to the distribution of coal to different bunkers or benches. They are not sufficiently exact for the total consumption. It is quite unpermissible to compute the quantity of coal according to the volume or by deducting the residue left. If in a special case the weight has to be partially calculated from volume, a series of trials must be made so as to ascertain the greatest possible error of the computation. The quantity thus computed should not, however, amount to more than 1 per cent. of the total quantity of coal carbonized.

The quantity of coal used should be determined exactly for each day of the trial. After the quantity required for the day has been carried, the breakers, elevators, and conveyors should be completely emptied. Coal which has fallen from the ends of conveyors, &c., must be carefully collected and added to the quantity for the day. The coal remaining at the end of the day in the bunkers should be weighed. After one day's trial, the quantity required can generally be estimated so exactly that only a few hundredweight will remain in the bunkers; and this should be drawn off in sacks and weighed on a small weighing-machine. It is advisable to provide an ample excess of coal for the first day of the trial, and weigh in sacks all that is left at the end of the day. This may be kept as a reserve for the following days, in case the quantity closely estimated to requirements for those days should not quite suffice on any one of them.

For the determination of the moisture, ash, and chemical composition of the coal and coke, a good average sample of each should be taken each day. The sample for the determination of the surplus moisture must amount to about 8 cwt. each day. It may be taken either as the coal is loaded or as it is discharged. It must be taken uniformly over the whole quantity; and the proportion of large to small coal must correspond with that of the bulk. The sample of about 8 cwt. is spread in a thin layer on a clean cement floor, and after remaining for three days, during which it is once turned, it is weighed again. The loss in weight gives the surplus moisture. Half of the sample is then broken on an iron slab and reduced by quartering to about 20lbs., which is put up in a metal box for examination in the laboratory. The sample is there further pulverized, and the ash, moisture (by drying at 105°), yield of coke, elementary composition, and calorific power, are determined. The surplus moisture determination is used for correcting the results obtained in the efficiency trials to the corresponding weight of air-dried coal.

(2) *Make of Gas.*—The make of gas is in practice ascertained by a station meter, which must be checked for accuracy according to the method described in the next appendix. The water level of the meter must be kept constant by means of a King's overflow, and checked twice daily. The make is read off half-hourly, and the temperature of the gas at the outlet of the meter and the pressure in the meter observed at the same time. The barometer is read four times daily. The meter thermometer should be compared with a standard thermometer, and the barometer examined to see that it is free from air. The pressure in the holder or in the meter must be taken into account in correcting the volume of the gas to normal. Air must not be used for the revivification of the purifying material; and as purifiers cannot be changed during the trials, one of them must be charged with new material just before starting. The foul-gas main and the tar-main must be cut off with a blank flange from any other setting. The pressure and dip in the hydraulic main must be maintained so that there is not a negative pressure on the retorts or chambers. In carbonizing chambers, however, with a level gauge in the receiving main there will be from 3-10ths to 4-10ths vacuum at the lowest part of the chamber. This condition is right only if the walls of the chamber are sound. The total make for the day is obtained by adding the makes for each half hour, corrected to normal; and the figures for the make per ton of coal and for the fuel consumption per 1000 cubic feet of gas are calculated therefrom.

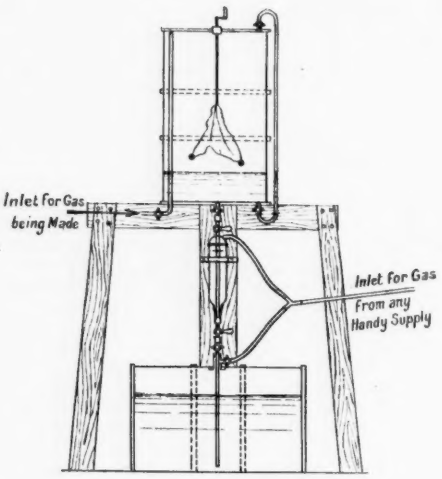
(3) *Quality of the Gas.*—Determinations of quality include (*a*)

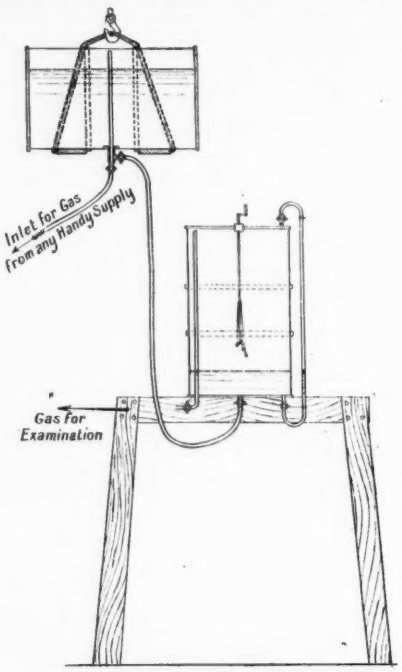
gross and net calorific power, (*b*) specific gravity, (*c*) percentage of nitrogen, (*d*) complete analysis of the gas, (*e*) illuminating power in a flat-flame and in the Carpenter burner, and (*f*) sulphur in the purified gas. As the gas produced throughout a whole day can rarely be stored by itself, either a sample for testing for quality is taken by proportion, or the more important determinations are made on the gas as produced at intervals of half-an-hour and the less important determinations are made on the gas before distribution. The concordance of results obtained by these two methods has been repeatedly proved. If the whole day's make can be stored separately, a smaller staff is required for conducting the trials, as the gas needs examining only every second day, and the holder emptied intervening days. The tests of quality should be made at three or four different positions of the holder.

For collecting mixed samples of the gas, an experimental holder of 35 to 100 cubic feet capacity is used, if available, and gas is drawn into it in proportion to the rate of production. If such an experimental holder is not available, the arrangement shown in figs. 1 and 2, which is constructed out of metal tanks, such as are used for gas liquor, is employed. The water is run off every half hour in quantity proportioned to the amount of gas produced in this time. The water runs into the second vessel, which, after the sample has been collected, is elevated, and is used to force the gas into a mixing-holder, from which it passes to the testing apparatus. The water used is well saturated with gas before the trial. Two such sets of apparatus are required for use alternately, and the vessels should be carefully tested for soundness. If it is necessary instead to make the tests of quality at intervals of half-an-hour, duplicate determinations should be made of calorific power and of specific gravity once every half hour. The results show the average quality of the gas each half hour, and this, in conjunction with the half-hourly make, gives the average quality of the gas throughout the time of carbonization. Allowance must be made for the time taken by the gas produced when the test is started to reach the testing apparatus. The other tests of the gas are made three times daily, on gas as it passes to the district mains, according to the usual methods.

The meter employed for the calorific power tests should be proved. This test is made on 10 litres (0·35 cubic foot) of gas. The water collected should be weighed, and the water of condensation should be determined for a consumption of 30 litres (1·06 cubic feet) of gas. Recording calorimeters should only be used for testing the uniformity of the calorific power, and not for its absolute determination. The specific gravity should be determined by the Bunsen-Schilling method; the time of efflux of air being repeated with each determination. The proportion of nitrogen in the gas is normally only 0·8 per cent.; and it affords an important criterion of the indraught of flue gas or air. It is determined according to Jäger's method, using acidified water in the burette. The levelling bottle is filled with gas and cut off from the air by means of an india-rubber bulb. The illuminating power is determined in a hollow-top slit burner at a consumption of 150 litres (5·3 cubic feet) per hour, and in the Carpenter burner at 5 cubic feet per hour. The connections must be well blown out with fresh gas.

(4) *Fuel Consumption.*—The quantity of coke consumed as fuel is determined by weighing, and stated in terms of absolutely dry coke; the coke in the clinker having been deducted. The coke used should have been produced from the coal which is being tested. The fuel consumption is determined separately for each





Figs. 1 and 2.—Apparatus for Collecting Average Samples of Gas as Made, for Subsequent Examination.

day. The clinkering of the producers, when there are several settings, is distributed so that an equal number of producers are clinkered every day, and the clinkering must be done at about the same hour. With step grates, which are clinkered less frequently, the amount of clinker is checked before the trial is started, and after its conclusion. At a particular hour (say, one hour before or one hour after the trial is started) all the producers are charged every day up to the lid. No dead spaces must be left in the producer. The fuel required for each day's consumption should, where possible, be weighed *en bloc* in railway waggons. The residue remaining unconsumed at the end of the day is weighed. The sampling of coke must be done even more carefully than that of coal, as the amount of moisture in it is considerably greater and less uniformly distributed. The sampling should be carried out by a skilled person. The sample should be at least 8 cwt., and after weighing should be spread out to dry; the larger pieces being broken and the sample turned several times. The second weighing should be made when freshly-broken lumps do not appear darker at the core. The drying off of surplus moisture generally takes three to four days. The large sample is then treated like the sample of coal, in order to obtain an average sample for further tests.

The observations become more difficult if hot coke direct from the retorts is used as fuel. It is then necessary to ascertain the ratio of the retorts from which the fuel is taken to the whole number of retorts discharged, and then to calculate the average amount of coke in a retort. The determinations should be repeated at frequent intervals, In any case the results are not completely satisfactory. The coke in the clinker is determined by throwing all the ash, clinker, and pan coke on to a screen of $1\frac{3}{8}$ inches mesh. The clinker is picked out from the lumps which remain on the screen, and the residual coke is dried and weighed. The remaining moisture and the ash are determined in an average sample in the laboratory. The ratio of the ash in the coke thus sorted out to the ash in the original coke shows whether clinker has been left in the former; and, if so, allowance should be made for it in computing the amount of coke in the clinker. It is a mistake to attempt to reduce the quantity of clinker removed from the producer, as the producer will then throw a greater back-pressure, and the heat of the settings will fall off. The temperature of the settings at the end of the trial should not be lower than at the beginning.

(5) *Yield of Coke.*—The determination of the yield of coke is useful for the sake of completeness, though it does not generally affect the efficiency of the setting itself. It depends primarily on the description of coal used. The daily determination of the yield of coke is valuable, however, as affording control over the estimation of the coal carbonized and the coke consumed as fuel. All the coke must be weighed, and from each batch a sample must be taken at the time and weighed for determination of moisture. The sampling of large quantities of coke discharged at different times with varying content of water is a difficult matter, but must be carefully carried out if any value is to attach to the results. The coke should, however, be quenched with as little water as possible, as the sampling and moisture determination become more difficult the wetter the coke is. It is often useful to know the relative proportions of small and large coke obtained. The yield of coke should be stated in terms of absolutely dry coke per ton of air-dried coal.

(6) *Duration of the Trial.*—Efficiency trials should extend over not less than four days. At least two clinkerings must be made in the period, in order that the fuel consumption may be correctly determined. The same coal as that on which the trial is to be made must have been carbonized in the settings for several days before the trial, in order that the proper charge and proper time of carbonization, and, where necessary, the extent of addition of steam, shall have been ascertained. Also the coke produced from the same coal must have been used in the producers. The trials should be as nearly as possible in working conditions, and a duration of at least four days precludes phenomenal results being obtained—*e.g.*, if a high make is secured, the calorific value of the gas and the fuel consumption will have been seriously affected in that time. In a trial carried out as described, however, more work is thrown on the staff, and small delays in charging, &c., are often unavoidable. On this account, better results have been obtained in continuous work at the Mariendorf and Munich works than in the efficiency trials.

(7) *Temperature of the Settings.*—The temperature of the settings must be maintained as nearly as possible the same throughout the trial, and in no instance must it fall; as in that case the determination of the fuel consumption would be incorrect. The temperature should be determined daily at about the same hour, having regard to the cooling effect of a fresh charge. Places in which the temperature should be taken differ with different settings, and the determinations serve rather to establish the uniformity of the temperature during the trial than to fix the exact temperature employed for carbonization. The temperatures are taken with a Wanner pyrometer, which is checked daily. It is important for the determination of the fuel consumption to ascertain that there has been complete combustion without much excess of air. This can only be ascertained by analyses of the fuel gas at the inlet of the regenerator. If this point is not accessible in the particular system of settings, the soundness of the regenerator of one setting is ascertained by simultaneous analyses of the gases at its inlet and outlet. If this test proves soundness, the proportion of carbonic acid in the flue gases and the temperature at the outlet of the regenerator will show whether in other settings the same conditions prevail as in the setting examined as described. If an abnormal proportion of carbonic acid or an abnormally low or high temperature is found at the outlet of any flue, the regenerator in question should be tested thoroughly.

(8) *Precautions for Guaranteeing the Bona-Fides of the Trial.*—It is obvious that care must be taken to prevent doubt or error coming into the results of trials owing to intentional or unintentional interference. All operations, weighings, fillings, samplings, and more especially the charging of the retorts and producers, should be directly carried out under the engineers in charge of the trial. The engineers of the firms interested are, of course, at liberty to point out any uncertainties or sources of error. As a protection against mishaps, seals should be placed on waggons, conveyors, charging apparatus, producers, and valves. In many cases it is possible to do all weighings and transferring of material in the day-time, and to seal up the coal-bunkers, &c., and producer lids for the night. The coal for the regular charges could then be taken from the weighed store in the bunker; so that from (say) nine in the evening till six next morning an engineer would not be required to watch the trial. If, however, the producers have to be charged, materials weighed or sampled, or coke removed, an engineer must be present at night also. From four to six engineers are necessary to carry out the trial, and each enters the results of his observations daily in a general note-book. All weight vouchers should be numbered, dated, and preserved, in case they are required for reference when the results of the trial are being worked out. By adopting the foregoing measures, the results may be guaranteed to be trustworthy.

Appendix 2.—The Proving of Station Meters.

Station meters should be proved under the pressure at which they will be used. The gas connection to the King's overflow must not be cut off, as in that case the water could flow below its normal level to the extent of the gas pressure. In proving the meter, it is supplied with gas under the gasholder pressure by opening the inlet valve. The outlet must be completely cut off from the system of mains. It is not sufficient to close the valve. Either a blank flange must be put on, or the bend or angle valve must be removed from the outlet. The gas is then passed from the station meter through a cock into the standard meter (see fig. 3). The standard meter must have been carefully standardized at a pressure of 16-10ths, and must be worked at this pressure. It should preferably be provided with arrangements for controlling its level and the position of the water. Dry meters are not admissible as standard meters. In default of anything better, an ordinary 100-light wet meter may be used. The pressure in the station meter and in the standard meter, and the temperature at the outlet of each meter, must be observed and any differences taken into account. It is desirable to fill the standard meter with water taken from another station meter in the same room, as thus equality of temperature is secured and the water is saturated. The manner of connecting the two meters is shown in fig. 3. The recording apparatus is removed from the station meter and a balanced metal pointer is attached to its axis. This pointer should extend to the outer rim of the meter, and will usually be 40 to 60 inches in length.

The apparatus is tested for soundness by closing the cock A, whereupon the pointer of the station meter should remain in the same position for half an hour; the temperature of the room and the gasholder pressure being constant throughout. Then gas should be admitted to fill the space between cock A and cock B to a pressure of 3 inches. With both cocks closed, this pressure must remain unaffected for at least ½ hour. The water in the standard meter must, of course, have been previously saturated with gas. The cock B is then fully opened, and cock A opened gradually until the maximum hourly capacity of the standard meter is reached. Then cock B is throttled until the pressure in the standard meter is 16-10ths. The position of the large pointer on the station meter is then marked with chalk for each revolution of the standard meter. The subdivisions of the circle on the station meter will then be approximately equal if the chambers of the drum are sound. If inequality is observed, the flow of gas is curtailed by throttling the first cock A and then the cock B to about half the former rate, and the observation is repeated. The differences will now be greater if the drum is unsound. If unsoundness is detected, the station meter cannot be used for the trials until it has been repaired.

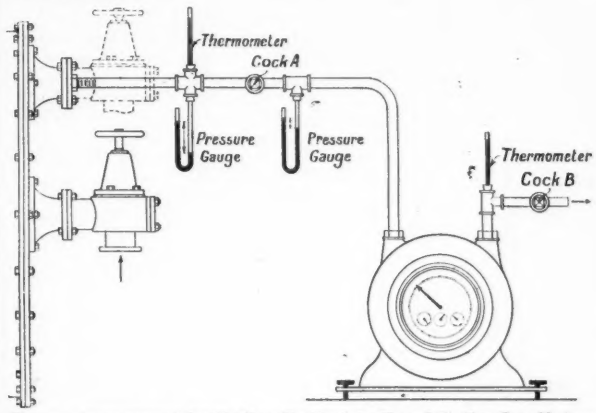


Fig. 3.—Arrangement for Testing the Registration of Station Gas-Meters.

The proving of the meter must be made on at least one complete revolution of the drum of the station meter, in order to exclude differences between the different chambers of the drum. It is better to take two to three complete revolutions of the drum. With old meters, the protruding axis is not always the axis of the drum, but is coupled with it by gearing inside. The capacity of the drum may in such cases be found on the delivery note or by calculation. All the readings should be made while the meter is in action, and not when the pointer is at rest. When the correctness of the station meter has been ascertained for one or more revolutions of the drum, the accuracy of the recording mechanism is checked by calculation and comparison with the indications of the standard meter.

CONSTRUCTION AND WORKING OF A SMALL SULPHATE OF AMMONIA PLANT.

By T. Hornby, of Longford.

[A Paper read before the Irish Association of Gas Managers.]

In bringing before you these notes upon "The Construction and Working of a Small Sulphate Plant," I wish it to be clearly understood that they are simply a record of what has been done at the Longford Gas-Works; and I hope that they will prove interesting.

Before going further, it will be well to inform you that sulphate of ammonia had been manufactured at the Longford Gas-Works during the years 1895 to 1898; but for some reason unknown to me had been discontinued. The plant used for its manufacture was of the intermittent type, and consisted of an under-fired boiler and still combined, with saturator, draining table, condenser, acid tank, and lead-lined store, with mother-liquor well. It was supplied by Messrs. R. & J. Dempster, Limited, and cost £136. The sulphate-house was built by local labour, and cost £118; making a total expenditure of £254. I believe Mr. W. A. Reid, who was then Gas Manager at Longford, read a paper before this Association describing the plant he had installed, which, at the time, was rather a novelty for small works.

When Messrs. Anderson Bros. took up the control of the Longford Gas-Works, in 1907, this sulphate plant had not been worked for seven or eight years, and had become practically derelict. It was decided, as an experiment, to fix in a still and heater of their own design, and to use any of the old plant that could be repaired. Upon my taking up the appointment of Resident Manager, in February, 1909, I found the erection of the new plant had been started, but had not proceeded very far towards completion, owing to press of other important alterations. When these were finished, I completed the erection, and put the plant into action in May, 1910.

Description of Plant.

The following is a description of the plant as it now stands: There are two overhead liquor storage tanks laid upon two H-steel

girders, which rest upon two brick piers at one end, and are built into the front wall of the sulphate-house at the other end. One of these tanks is an old vertical scrubber, the inlet and outlet being made-up. The other is an old Cornish boiler, the ends of the fire-tube being closed by two circular cast-iron plates pulled up tight against the boiler ends by means of a 1¼-inch tie-bolt. The fire-tube being left in, it was necessary to drill a few holes in it to get the full capacity. These tanks are fixed 10 ft. 6 in. above the floor level of the house. Their total capacity is 1840 gallons.

The liquor is pumped up from the well by a pump fixed upon the wall of the exhauster room, and driven by chain gearing from a countershaft. This pump delivers the liquor to a funnel on the top of the tank fixed farthest from the wall. A 2-inch pipe is taken from the funnel to within 3 inches of the bottom of the tank, to prevent evaporation of ammonia. The liquor outlet pipe is at the other end, and is 6 inches from the bottom; and should any tar be pumped up by mistake, it would be detected before it rose to this height. This pipe is taken in to the bottom of the second tank, and the outlet pipe is fixed at the opposite end, and projects 10 inches inside the tank, so that any particles of tar have a chance to settle and not get into the supply pipe to the heater. Each tank has a separate valve to draw off tar; and the liquor outlet pipe from the tank is shut off from the plant by another valve.

The liquor gravitates through a 1-inch steam-tube to a valve fitted with a quadrant, to ensure a fine adjustment of supply to the heater. The heater was built up from an old 18-inch spigot-and-socket pipe, having a cap fixed on the spigot end. A 6-inch flanged pipe was then lowered inside the 18-inch pipe, and the flange bolted down to the cap—a special casting being made to act as a plug for the 18-inch socket, and also as a sleeve joint to fit over the 6-inch spigot as well. A lead joint was made here, then a flanged connection was bolted down over the end of the 6-inch pipe—thus making two separate compartments. The liquor inlet is at the centre of the 18-inch cap, the liquor passing up the 6-inch pipe and away at the top; provision being made at the bottom of the heater for the devil liquor to run away to a seal-pot, and thence to the sewer. [Reference to fig. 1 will explain more fully the construction of this heater.] The hot ammoniacal liquor then passes through a 1-inch wrought-iron pipe to the still, and enters near the top; this pipe being fitted with malleable iron connections and tees, to facilitate clearing in case of a stoppage.

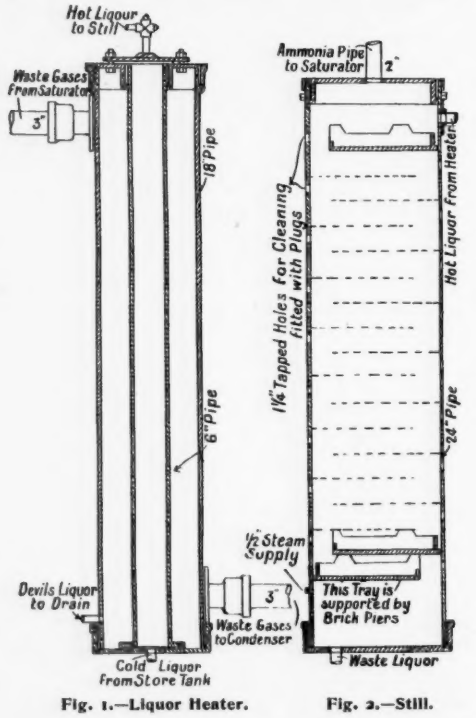


Fig. 1.—Liquor Heater.

Fig. 2.—Still.

The still is fixed 1 ft. 6 in. away from the heater, so that all parts can be got at. It rests on a concrete base, and is built up of an old 24-inch spigot gas-main, 8 ft. 6 in. long, with a cap fixed on one end. Inside this pipe are fixed eighteen trays, 3 inches deep for two-thirds of their circumference. The remaining portion, where liquor overflows, is 1 inch deep. The bottom tray rests on brickwork a foot high. The other trays, resting upon each other, are placed so that the descending liquor flows, in a zig-zag fashion, down to the bottom of the still, where it flows out at a seal-pot, 12 feet deep, and thence to the sewer. The joints between the trays and the pipe were made by gaskin, caulked tight, and then liquid cement grout run in. In the 24-inch pipe, opposite each overflow of trays, 1¼ inch holes were drilled, and fitted with plugs for clearing purposes. A gauge is fixed near the bottom of the still, so that, in the event of the overflow pipe choking, the liquor would show in the glass tube, and so warn the attendant.

Steam is admitted near the bottom of the still; the supply being controlled by a quadrant cock, to ensure a fine adjustment. A steam pressure gauge is fixed on the supply pipe after the cock; the seal in the U-tube being mercury, so that when the plant is not at work the ammonia gases cannot have any action on the brass work of the gauge. The top of the 24-inch pipe was closed by a plug and jointed by lead; a wrought-iron band being shrunk-on the end of the pipe to prevent splitting when caulking. Fig. 2 will explain the construction in detail.

The steam heats up the descending liquor and drives off the free ammonia at the top of the still, where it is taken away to the saturator by means of a 2-inch wrought-iron pipe. This pipe is fitted, where necessary for cleaning, with cross tees. There is also fixed an intercepting box before the pipe drops to the saturator. This box is drained back to near the bottom of the still. We have no secondary still or lime leg, as it would have complicated the plant. The extra expense of lime, at 15s. per ton, and labour would not be recouped by the recovery of fixed ammonia in such a small plant as ours, although, of course, we are well aware we cannot expect as large a return of sulphate per ton of coal without a liming still. But if the present plant proves successful, it is intended to add a liming still; the nature of the yard levels enabling this to be done readily.

The saturator is 2 ft. 7 in. wide by 2 ft. 8 in. long by 2 ft. 3 in. deep, and is made of ¼-inch lead plate. It was found to be in good condition, and no repairs were necessary. To heat up the acid in the saturator when starting the plant, we fixed a 1¼-inch lead pipe, running it down at one corner and along the bottom, and up the opposite corner, connecting up the end to a steam-trap.

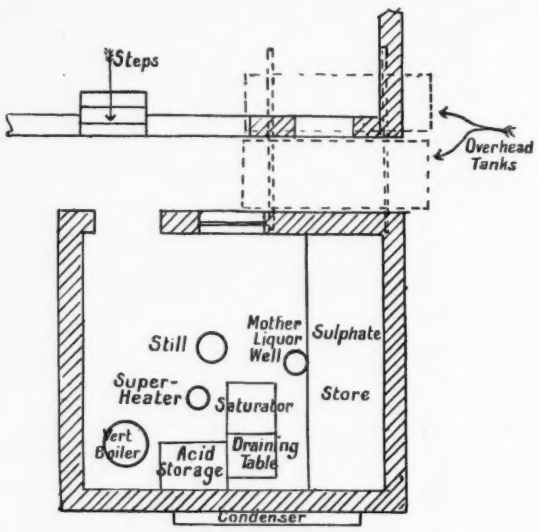


Fig. 3.—Plan of Sulphate House.

The draining table is fixed on the wall, at the side of the saturator. It is 2 ft. 6 in. wide by 2 ft. 6 in. long by 9 inches deep. Acid is stored in a wooden tank, lead lined, 3 ft. 8 in. by 2 ft. 6 in. by 2 feet, which is fixed on the wall, in a line with the draining table and close to the saturator. Its capacity is 15 cwt.

The sulphate-store is at one end of the house. It is 17 ft. 6 in. long by 5 feet wide, and is lead lined. The floor is drained to the centre, and then to the front, where the mother-liquor well is sunk, which is also lead lined, and is 2 feet deep and 1 ft. 6 in. in diameter. From the heater the waste gases pass to the condenser, which consists of a range of 3-inch flanged pipes, fixed horizontally against the back wall of the house, and then on to the purifier, which is made in the form of a pit, 7 feet long by 4 feet wide by 9 inches deep. A grid is fixed in the opening of the pit, and oxide heaped upon this.

Steam is generated in a 4 H.P. vertical boiler, fixed in the corner of the house next to the acid storage-tank. The boiler, still, heater, and piping have all been covered with Leroy's boiler composition since we commenced working the plant, and the saving in fuel is very perceptible. The total cost of the reconstruction of this plant was £79 16s.—£58 14s. being for new boiler, pipes, castings, &c., and £21 2s. for labour.

Method of Working.

The following is the method adopted in working: The liquor is worked up to 6° Twaddel by a Clapham washer-scrubber of 90,000 cubic feet capacity per twenty-four hours. It flows to an underground tar well, and thence to the liquor well, which holds, approximately, 2000 gallons. It is next pumped up to the overhead tanks, as before mentioned. When both overhead tanks and well are full, our total storage capacity is, approximately, only 3800 gallons, which is not enough; and we intend putting up an extra tank as soon as possible. When our storage is filled, the night stoker puts the fire under the boiler, at about four a.m., and while steam is rising goes round the plant to see that everything is in order. When the steam has risen to 40 lbs., he turns it on to the 1¼-inch lead pipe fixed in the saturator, to heat up the acid, and also on to the still, and heats up slowly until steam issues freely from the vent-hole in the ammonia pipe at the inlet of the saturator. He then puts

in the plug; and by the time the sulphate maker comes on duty at 6 a.m., the plant is quite hot and ready for work.

The strength of the acid in the saturator is made up to 70° Twaddel, and then the liquor supply to the heater is opened. As already mentioned, the liquor supply cock is fitted with a pointer and quadrant, the latter having notches to show the flow of liquor; the proper flow having been determined by keeping a close watch upon the waste-liquor overflow. The steam is kept on to the pipe in the saturator for about an hour, and is then shut off, as we found that if we kept it going the whole time until we fished out the sulphate, the salt was very dirty looking.

The steam pressure at the boiler is got up to 80 lbs., and is kept as near this as possible. The pressure is reduced to 8 lbs. at the still. After about six hours, the sulphate begins to form; and when the gravity falls to 57°, we fish out the sulphate on to the draining board, leaving it there to drain until the next lot of sulphate is ready, when we remove it to store. To prevent the gravity falling below 54° while fishing, a small stream of acid is run into the saturator. The average time it takes from making-up gravity in the saturator to finishing fishing sulphate is nine hours; and the make of sulphate is approximately 3 cwt. per run.

The liquor is generally used up in about five days; and we make from 15 to 17 cwt. of sulphate in this time. Constant tests of the temperature of the liquor in the saturator, are taken; and I find by keeping it up to about 220° Fahr. we get the best results. The temperature of the liquor at the head of the still is about 170° Fahr.; and the temperature of the waste liquor at the outlet is about 180° Fahr. In a test run of twelve hours' duration, the temperature was taken every ten minutes at the following points: Acid in saturator, liquor taken from the pipe at the head of heater, and waste liquor overflow from still. The following are the average temperatures recorded: Acid in saturator, 228° Fahr.; liquor taken from head of heater, 167° Fahr.; waste liquor from still, 180° Fahr. A thermometer was also fixed in the liquor pipe between the heater and still; and this recorded an average temperature of 191° Fahr. This temperature record I consider the most accurate, as, no doubt, when drawing liquor from the pipe between the still and heater, the temperature would drop a little.

We have to keep 8 lbs. steam pressure upon the still, as I find that we cannot drive off the ammonia from the liquor very well with anything less. One reason for this may be that, as will be seen from the sketch, the trays in the still have no serrations, and consequently, only direct steam heating of the ammoniacal liquor takes place. The tray castings were left rough; and as a large surface is exposed, splashing of liquor occurs in the descent from tray to tray.

The sulphate we made for the first two or three runs was very varied in its colouring. We had five or six different shades in red, which were probably due to impurities in the acid, and then we got a lot of dirty, muddy-looking salt. The muddy colouring of the salt I found was due to the fact that we were using the heating pipe in the saturator too long, and that the froth which forms on the acid settled down and mixed with the sulphate. Since we have used this pipe only for keeping up the temperature while getting up the gravity after fishing, we get a very nice white salt. The samples shown represent a fair average of the bulk now in store.

I heard of tar being used in the saturator to liberate the impurities in the acid. I tried it, and find that by pouring ½ pint of tar down the acid funnel into the saturator, when making-up the strength of liquor after fishing sulphate, that we get a very much better coloured salt.

Troubles Experienced.

When we first started the plant, we had trouble in keeping down the mother liquor, and soon had about a dozen carboys, besides the well full. After some time I found the fault to be that of over-steaming the still, which was not lagged, and consequently it lost a lot of heat by radiation. After covering the still with Leroy's boiler composition, I experimented for some time to find the most suitable steam pressure to work at. I have fixed it at 8 lbs.; and since then we have worked-up all the surplus mother liquor, and we frequently have to add water to the liquor in the saturator to make it up to the required depth, without getting the strength above 68° Twaddel—the usual depth for best working being, approximately, three-quarters the depth of the saturator.

We had some trouble in keeping down the smell from the waste gases from the purifier; and though we kept changing the oxide, the effect was not much better. I found this was due to the condensers not being of sufficient size, and that the waste gases were too hot for the oxide to do its work efficiently. I laid a water supply to the condensers, and fixed a pipe, with eight small cocks inserted in it, over the top pipe. Spun yarn is coiled round the pipes, to distribute the water over a larger area as it drips downwards from pipe to pipe; and by this means I can keep the waste gases quite cool at the condenser, and we have got rid of the bad smell from sulphuretted hydrogen at the purifier.

For some considerable time I had no trouble whatever; we got back-pressure at the saturator and still. On investigating matters, I found every pipe of the condenser nearly choked solid with a salt which I took to be ammonium carbonate, as it dissolved very easily by pouring hot water down the pipes. After cleaning the pipes, I adjusted the water supply so that it is only just sufficient to cool the pipes, but does not chill them. Since doing this, we have had no further trouble.

The results for the year ending May 1, 1911, were disappointing, as from the liquor produced from the carbonization of 948 tons of coal I recovered only 92 cwt. of sulphate of ammonia, which equals 10·86 lbs. per ton of coal carbonized. I looked round to see if I could find the remedy for the loss; and by keeping a strict watch on the waste liquor overflow, and taking frequent tests at the waste-gas pipe at the head of the saturator, and also at the outlet of the condensers, to prevent loss of free ammonia, I have this financial year improved the results very considerably.

The liquor well was covered by a wooden trap-door. This struck me as being another source of loss. I replaced it with a cast-iron inspection trap; and, instead of using water as a seal, I filled the groove with grease. The well is now practically air-tight; and the saving in ammonia will soon pay the few shillings cost of the sealed lid.

Recent Results.

For the financial year ending May 1, 1912, the sulphate of ammonia produced was 142½ cwt., and the coal carbonized 939 tons 13½ cwt. Thus the make of sulphate per ton of coal carbonized was 16·98 lbs., or an increase of 6·12 lbs. per ton over the previous year. Some allowance must, of course, be made for the fact of its being my first experience of sulphate making, and also that of the man who works the plant; and it must also be borne in mind that the fixed ammonia is not recovered.

It is not my intention to go into details as to the cost of working and profits; but I may say that my Directors are so well satisfied with the plant and its working results that they purpose installing a similar plant at another works under their control.

Discussion.

Mr. H. Hawkins (Limerick) said when he went to Limerick seven years ago they had no sulphate plant. He directed his attention to this loss of profit, and they put up plant of their own make, which cost some £330. During that year, they not only paid the cost of plant, but made a profit of £600 beyond; and they had done well ever since. They produced last year—March to March—118 tons of sulphate, and sold it at £12 10s. per ton; so that they made a nice profit. They paid fair wages—two men working the plant in twelve-hour shifts for £2 a week. Any member with a 20 million cubic feet output should direct his attention to sulphate making, which was not only a source of profit, but did away with a cause of nuisance. He congratulated Mr. Hornby on his paper, which was a most interesting one. He added that if any of the members happened to be in Limerick, he should be glad to show them his plant in operation.

Mr. J. F. Tyndall (Wicklow) said the question was one of profit—whether sulphate making could be made to pay. This matter had been overlooked; but he held that it was of great importance, and should be carefully considered. He referred also to the importance of the size of the gas-works in dealing with the matter.

Mr. W. E. Young (Tipperary) said that he had installed similar plant to that referred to by Mr. Hornby. He dealt chiefly with the time taken to make 15 cwt. of salt. In practice, and starting the saturator cold, he got the first of the salt in seven or eight hours; while he frequently obtained subsequent results in four hours. Mr. Hornby should not rest content until he could increase the amount of his output. He (Mr. Young) was not in a position to criticize the yield of sulphate per ton, as he had only had the plant for a short time; but on the basis laid down, he had 16 lbs. per ton of coal carbonized, which represented only a portion of the coal used annually.

Mr. D. M'Intyre (Dungannon) said that, being the Manager of works making 10 million cubic feet, he could not see, from the discussion, that there would be any advantage in erecting a continuous sulphate of ammonia plant, as he had had some intention of doing. He had in Dungannon a boiler in which the ammoniacal gases were driven off the liquor with a steam coil; and for the past year his make of sulphate was 18 lbs. per ton.

Mr. T. J. Reid (Ballina) said they should be sure of the lines upon which to instal sulphate plant. He would like to be certain that the working of the plant would pay commercially. He was not satisfied that it would; and he asked Mr. Hornby to let them know the profit on his operations. They needed more information as to the adoption of the plant in a 10 million works, and also as to the conversion of old plant.

The President (Mr. C. B. Outon), in bringing the discussion to a close, said he had read Mr. Hornby's paper with great interest, and he should like to offer a few remarks upon it. He noticed that Mr. Hornby had made very ample provision for separating the tar from the liquor; and he thought that in doing so he had taken a wise course, because, from his personal experience, extending back only to the last seven years, he could say that any trouble they had had in connection with their sulphate plant had entirely arisen from carrying off tar in conjunction with the liquor. The effect of the heat on the tar was to convert it into pitch, producing back-pressure; and thus there was no alternative but to pull the still asunder in order to remove this injurious element. He noticed, too, that Mr. Hornby referred to his purifiers giving trouble, and exhaling offensive odours. He thought the smell to which the author referred was partly due to the "devil" water, which was so unpleasant; and, if the members recollected, in a paper which he had the honour of bringing before the Association in 1905, he mentioned that they sloped the condensers towards the inlet, and not, as many of them would do, towards the outlet. He was prompted to do this by one of the

Inspectors, who assured him that the hot water that would condense at the inlet would not be so highly impregnated with sulphuretted hydrogen in the heated condition, and that there would not be the same degree of offensiveness when the "devil" water was allowed to percolate through. He did not think Mr. Hornby should rest satisfied with his results. There was not the slightest doubt that the addition of the lime leg would give him a greatly improved return. Of course, he knew this already, as he (the President) felt sure; but he would doubtless bear in mind that at the present time all he was doing was to discharge the ammonia with the sulphates and cyanides, and the remaining sulphates passed on to the effluent liquid. It was admitted, as he understood, that at least 20 per cent. of the ammonia was carried away in this directien, unless it was acted upon by a substance like lime, or any other element with a similar action. The result of the addition of lime would, therefore, appear to be that he would gain to the extent of 25 per cent. at least on his present return. Speaking personally, he himself was not able to get the same return per ton of coal the members would see mentioned in various prints and books. He had totalled it up that morning, and had found that their average return amounted to from 24 lbs. to 26 lbs. of salt per ton of coal carbonized. Mr. Hornby would, therefore, see that he had a large margin to make up; and he (the President) felt sure the difference could be made up by the addition of the lime leg. In his own paper, to which he had already referred, he gave the members a balance-sheet. In fact, he thought the figures would have far greater interest than the composition of the paper. Any estimates then made had been amply fulfilled by the experience gained in the intervening years. He told them then, as he remembered, that he considered they should have something like 40 per cent. on their outlay; and this prediction had been more than verified. He did not wish to take up any more time; but possibly Mr. Hornby, in his reply, would tell the members what, in his opinion, was the minimum size of gas-works in which sulphate plant could be profitably employed. He (the President) was disposed to differ from Mr. Hawkins in his figure of 20 million cubic feet, and thought that works of even half this magnitude would be found to constitute a convenient unit to which the addition of sulphate plant would be found to be an important contributor on the credit side.

Mr. Hornby, replying upon the discussion, said, with reference to the remarks of Messrs. Young and Reid, he was not at liberty to give the figures of cost; but he pointed out that he made ample profit to cover cost, and reminded them that the plant had not to be provided, as it was in already. Mr. M'Intyre, he believed, was using lime, and so was getting fixed ammonia also. In his opinion, even on an 8 million cubic feet works the result would pay. For his own part, he did not claim to have achieved anything remarkable. He did the best with the plant under his charge. He was handicapped to an extent by insufficient liquor storage and otherwise; but, as he had said, he did his best, and had no reason to complain of the result.

Gas Profits at Warrington.—At a meeting of the Warrington Gas Committee, it was reported that the profits from the gas undertaking for the year ended March 31 amounted to £16,367. It was resolved that the Sub-Committee appointed to report upon the administration of the undertaking be requested to consider and report upon the financial position as disclosed by the balance-sheet, the allocation of the profits, and the preparation of future balance-sheets with regard to their acceleration. The minutes of the Committee have been adopted by the Town Council.

Reduction in Price at Tiverton.—At the meeting of the Tiverton Town Council yesterday week, a report was presented by the Lighting Committee recommending that the price of gas to ordinary consumers should be reduced to 3s. 4d. per 1000 cubic feet. Alderman J. Thorne, the Chairman of the Committee, stated that this was a reduction of 2d. The profit last year was £700, and £200 of it was used in reduction of the rates, and £500 was placed to the reserve fund. It was assumed that there would be a similar profit in the current year; but coal would cost 1s. 6d. per ton more, or £300 in all, and a reduction of 2d. per 1000 cubic feet would absorb £333. It had been suggested that the reduction should be 3d.; and Mr. Jeffery, the Gas Manager, with whom he had discussed the matter, told him he thought it would be safe to take off 3d. He should not, therefore, offer any opposition if it was proposed to make the reduction this amount. It was thereupon agreed that the price should be at once reduced to 3s. 3d. per 1000 cubic feet.

East Surrey Water Company.—At the recent annual general meeting of this Company, the Directors reported that the profit for the year was £31,538, which, with the balance of £6122 brought forward, made £37,600. Out of this, the Directors placed £4000 to the renewal and contingency fund; and they recommended that dividends of 5 per cent. upon the preference shares, 7 per cent. upon the ordinary shares, and 10 per cent. upon the original ordinary shares (less income-tax in all cases) should be declared for the year. Interim dividends to the amount of £9571 having been paid, those recommended would absorb £9571. There was a balance of £8200 to be carried forward. The Chairman (Mr. Peter Riddoch) moved the adoption of the report; and the motion was seconded by the Deputy-Chairman (Sir Myles Fenton, J.P.), and carried unanimously. A vote of thanks having been accorded to the Directors, the Chairman acknowledged it, and proposed that thanks should be given to the staff. He said that in Mr. Cornewall-Walker they had an efficient Engineer, Manager, and Secretary; and the Directors were ably assisted by the whole of the staff of the Company. The vote was cordially passed, and acknowledged by Mr. Cornewall-Walker.

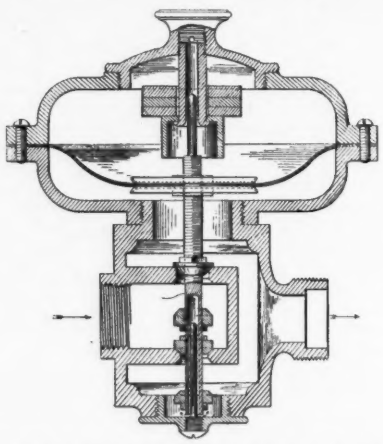
REGISTER OF PATENTS.

Gas-Governors.

Wilson, G., of 's-Gravenhage, Holland.

No. 9151; April 12, 1911.

This combined automatic gas regulator and safety governor has two valves or two sets of valves, one to control the flow of gas, and the other to act as a safety control by cutting off the main gas supply. The valves are preferably carried by a spindle controlled by a diaphragm situated in a chamber in communication with the gas-outlet.



Wilson's Combined Automatic Gas Regulator and Safety Governor.

The following is a description of the preferred form of construction (shown) according to this invention: In the casing is the gas inlet chamber provided with two valve seatings, one above the other. Through these seatings works a spindle which carries two pairs of valves, so arranged that each pair is in engagement with its valve-seating at the same time. In a casing, preferably above the gas inlet chamber, is a diaphragm connected with the spindle. The casing which contains the gas inlet chamber also serves as the gas outlet chamber, and communicates with the underside of the diaphragm. The spindle which passes through the gas inlet chamber has formed in it a passage which serves two purposes—namely, to act as a guide for the spindle, and also as a gas-way to put into communication the gas inlet and outlet chambers. For this latter purpose a hole is drilled through the spindle into the passage to connect the passage with the inlet chamber, and the passage terminates at the bottom in the outlet chamber. The upper end of the spindle also works in guides—the guide preferably having a vent in it to act as a release for the space above the diaphragm. The spindle (and thus the diaphragm) is loaded by means of a spring or weights when in about its highest position only, for the purpose to be described.

The operation of the governor is as follows: Assuming the governor to be fixed in position, and the piping connected to the inlet and outlet, the cock on the inlet being open, the gas will enter the inlet chamber, and will then enter the gas outlet chamber and the piping by passing through the small hole in the spindle and through the passage in the spindle. When the gas has filled the pipes, the pressure in the outlet chamber will increase, and the diaphragm will be lifted. As soon as this lifting commences, the first pair of valves are lifted off their seating, and the gas can freely enter the gas outlet chamber. When the pressure in the gas outlet and piping is sufficient, the diaphragm will have been raised until the second pair of valves come in position in their seatings, and prevent any more gas leaving the gas inlet chamber. The small hole in the spindle will also be put out of action. Assuming now that taps in the piping are open, the pressure in the gas outlet chamber at once diminishes, and the second pair of valves leave their seatings, and allow fresh gas to enter through the gas inlet chamber into the gas outlet chamber. Thus the governor automatically regulates the amount of gas supply.

Should the gas be shut off on the inlet side, the valves would fall upon their seating, and prevent the flow of gas when the inlet is open again, until a certain pressure is obtained at the outlet, when the operation will take place as already described. The governor can be adjusted to operate at any particular pressure by adding additional weights or a spring to operate the spindle. These weights should only operate when the diaphragm is in its highest position, as otherwise the governor would shut off the supply of gas when a large quantity of gas at a very low inlet pressure is being passed.

Incandescent Gas-Burners.

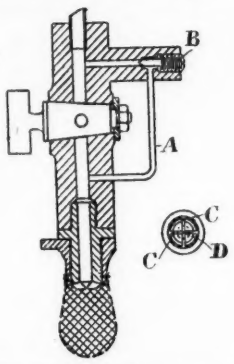
Svenska Aktiebolaget Gasaccumulator, of Stockholm.

No. 23,930; Oct. 28, 1911. Date claimed under International Convention, Nov. 3, 1910.

This invention refers to an incandescent burner in which a pilot flame is burning only when the main flame is extinguished. The burner is fitted with a cock whereby a main conduit can be closed—a smaller pilot supply conduit being arranged to place the portion of the main conduit at one side of the cock in communication with the portion at the other side; the cock being arranged between the mixing-chamber and the burner mouth, so that, instead of controlling the gas supply only, it controls the gas mixture supply.

For supplying the burner with gas for the pilot flame a bye-pass con-

duit A, leading from below the cock, is connected with the gas-conduit or with the gas-channel above the cock; and for regulating the quantity of gas flowing through, a screw B, accessible from the outside, is provided. When the cock is closed, the burner is supplied with gas flowing through A; and thus a pilot flame corresponding to the quantity of gas



A Swedish Pilot Light Incandescent Burner.

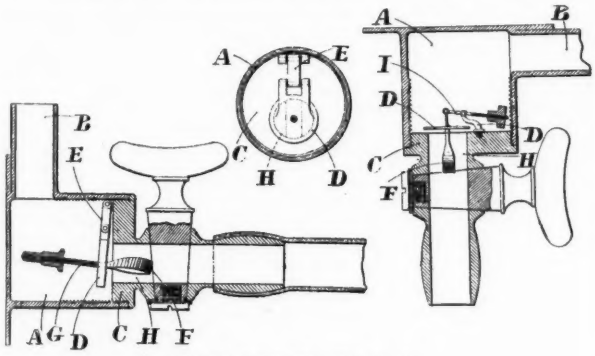
flowing through the conduit is kept alight. The end of the burner is formed with at least two slots C, intersecting each other at right angles and communicating with the gas-channel. Thus the pilot flame will burn steadily at the point D, where the slots intersect, "instead of fluttering so as to be extinguished at one point and again lighted at another point, which is the case if one single slot or a number of parallel slots are used."

Safety Devices for Gas Apparatus.

PICOT, G. F., of Paris.

No. 27,129; Dec. 4, 1911. Date claimed under International Convention, Dec. 23, 1910.

This invention particularly relates to devices which consist of balanced valves situated in gas-supply conduits, and which are adapted to cut-off the supply of gas when from any cause the supply should attain an excessive amount; the valves being adapted to oscillate about a horizontal shaft, and being provided with a member (having an adjustable counterweight), either in the form of a screw-threaded spindle carrying a nut, or a spindle upon which the counterweight is clamped by a screw. The valve is adapted to oscillate about a horizontal shaft, and carries a member having an adjustable counterweight on one end, while on the other end there is a projection which co-operates with a plug valve in the conduit in the manner hereafter described.



Picot's Safety Gas-Tap Device.

The apparatus represented in fig. 1 comprises a cylindrical box A, with a horizontal axis provided with a socket B, through which the gas enters. The box receives a threaded flange C, formed on the casing of the cock. In the cock-casing is a control plug provided with a port. The cock-casing also comprises a socket or nipple for a flexible pipe. Opposite the inlet of the cock-casing a valve D is mounted. It is connected with the flange C by a pivoted rod E, and is capable of inclination around a horizontal axis. Upon the valve there is fixed on the one side a projection F, and on the opposite side a rod G, upon which a nut, forming an adjustable counterweight, is screwed. This counterweight is arranged in such a manner that in its position of equilibrium the valve D is slightly open—the angle of aperture increasing according as the normal gas pressure is higher.

When the apparatus to which the tube is attached is operating normally, the gas encounters a certain resistance at the points at which it is lit. The pressures that are exerted upon the two faces of the valve D are approximately equal; and if the nut on the rod G has been placed in a suitable position according to the pressure of the gas on leaving the meter, the valve D is opened. If the pipe should become torn or detached, atmospheric pressure is re-established behind the cock; and the pressure of the gas being higher in front of the valve, the latter is applied to the flange C, and obturates the orifice H, thereby interrupting the passage of the gas and consequently preventing any accident from occurring.

After a stoppage produced by the device, the valve can be separated from its seat. In the closed position the projection F slightly penetrates the opening of the plug of the cock; and in order to bring the valve back to its normal position, it is only necessary to rotate the cock plug, thereby pressing the projection F and opening the valve. If the plug then be opened, the gas will pass in the usual way.

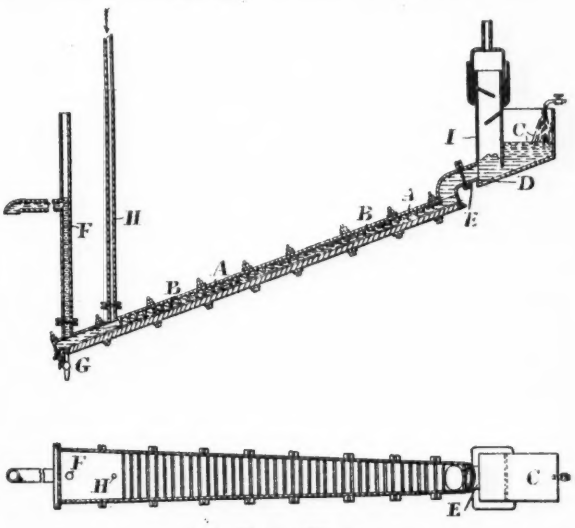
Fig. 2 shows a different construction suitable for vertical conduits. Here the valve is arranged horizontally. In this case, the valve is suspended by a chain from a lever I pivoted to a support J. The free end of the lever is threaded for the reception of a nut, forming a counterweight; its position being adjusted in such a manner as to suitably balance the valve. In this case, also, the valve comprises a projection, which in the closed position of the valve enters the aperture of the plug of the cock and enables the valve to be detached from its seat.

Gas-Washer.

AMINOFF, G., of Baltimore, U.S.A.

No. 126; Jan. 2, 1912.

This invention operates by the simultaneous passage of gas and liquid in opposite directions, in a steeply inclined "chute" having depending partitions which cause the gas to pass successively through a series of liquid columns. The chute is closed at the sides and bottom, forming a liquid and gas passage-way, with a series of depending partitions set in the upper part, but not extending to the bottom.



Aminoff's Gas-Washer.

The illustration shows a longitudinal vertical section of the apparatus, and a section seen from beneath.

The main part of the washer consists of a steeply inclined tube having top, bottom, and sides forming a channel for the passage of the gas and liquid. The upper part is subdivided into boxes A by partitions B, extending from side to side and from the top halfway (more or less) toward the bottom. This construction and the inclination form a series of closely-set boxes, in which portions of the liquid are held and exposed to the action of the gas. At the upper end is a tank C, into which water is fed from a supply pipe. The bottom of the tank is inclined, and the tank is separated from the gas-exit pipe by a wall, at the bottom of which is an opening through which the liquid may pass underneath the gas-exit pipe, over a shoulder D, and through a passage E into the upper end, just below its end wall. The passage pipe E is made in two parts held together by flanges. The lower end is also closed, and an overflow pipe F for the liquid is set in this lower end. It is provided with a discharge branch, set at a proper point in height in relation to the tank, so as to maintain the liquid in the boxes. A drain pipe and faucet are indicated at G. Above the pipe F, and below the series of boxes, is a gas supply pipe H. At the upper end is a gas-exit pipe I, the lower end of which opens into the liquid passage from the tank, so that the gas, rising therein, can escape from the liquid and rise in the pipe. Baffles are set, preferably inclined, in the pipe I, to throw back the spray.

The apparatus being properly adjusted, the gas will occupy the boxes, while the liquid rises from the clear passage and presses upon it in the boxes while the outward flowing gas rises, flowing under the lower edges of the partitions and from one box into the other.

Generating Rich Gases.

LAHAUSSOIS, R., of Paris.

No. 3113; Feb. 7, 1912. Date claimed under International Convention, Feb. 15, 1911.

This invention relates to apparatus for the generation of rich gases produced by treating liquid fuels, which are not very volatile, for working gas-engines. The process consists in passing through an electric arc a mixture of not very volatile combustible liquid and water, both in the pulverized state, "so that the decomposition of these substances into their constituent elements and their reconstitution in accordance with their chemical affinities produce, after this passage through the arc and after subsequently passing through a layer of incandescent coal, an exceedingly rich gas, rich mainly in carbon monoxide."

The patentee's specific claim is for the "production of rich gases for gas-engines, derived from liquid fuels of small volatility, by means of a gas-generator, the construction of which is based on the principle that a mixture of slightly volatile liquid fuel and water in the pulverized state is caused to pass through an electric-furnace, so that the decomposition and reconstitution of the mixture produce, after this passage through the furnace and after subsequently passing through a layer of incandescent coal, an exceedingly rich gas—rich mainly in carbon monoxide—which after its passage into a cooler is collected in a gas-holder, whence it is drawn away by the gas-engine."

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents]

The Ilkeston Gasholder Disaster.

SIR,—Referring to the accompanying sketch of the Ilkeston gasholder as it was immediately before the disaster, and coupling with it the facts that the outer lift, though submerged 12 ft. 6 in., remained undamaged, and that the three main fractures OA, OB, and OC meet at a point O, what have your readers to say against the following opinions?

(1) Since the lift remained undamaged, the level of the water can never have been much higher inside the lift than outside in the tank during the period of disaster.

(2) Hence the water could not have commenced to flow from the rupture at A, but must have commenced at a lower level, say at O.

(3) Also, the fracture OA could not have taken place momentarily, or the 3000 tons of water within the outer lift must have burst its flimsy shell.

To the above might be added—

(4) The three main fractures OA, OB, OC meeting at a point O can only be accounted for by the junction O being considered as the initial point of damage, similar to the radiating fractures from a broken window-pane.

(5) The point O, being situate in a riveted lap-joint, said to be two-thirds the strength of the plates jointed, $\frac{2}{3} \times \frac{7}{4} = 2\frac{1}{2}$ factor of safety of the tank as a structure.

(6) The factor of safety at A, where the tear passed through the solid plate, being 10, it seems unlikely that A was the starting-place.

Without labouring these points, do not these factors satisfactorily show (*a*) that the tank burst at the point O, and that (*b*) the spiral guides are exonerated from culpable blame?

July 8, 1912. AMICUS.

Day Load: Average Consumption per Head of Population.

SIR,—I have followed with some little interest the discussions on the above question; and it seems to me that there is a wrong impression in regard to the value for comparative purposes, of the average annual consumption per head.

I am inclined to discount the basis, because of the varying circumstances and conditions operating in different townships. There was some value in the figure many years ago—before the advent of electricity and slot-meters; and more recently the practice of some large undertakings specializing gas at low prices for high-pressure industrial purposes. I do not blame the latter, as it is quite a local problem, and probably pays back indirectly the same as other public facilities. But I do object to comparisons with undertakings not similarly circumstanced; and more or less every corporation or company has its own problems and local conditions to meet.

The point is that the influences above mentioned do not operate in the same degree all round. Therefore, even with cheap gas the comparison is not reliable. You may have electricity owned by a corporation, who do or do not manage it to the disadvantage or advantage of the gas undertaking similarly owned. Or one or the other may be owned by a company; and then the boot is on another leg. And so on, you get numberless complications even with this one question (of electricity).

That slot meters have brought additional business is not denied; but they have been the means of assisting in reducing the average annual consumption per head, or consumer as I prefer it—the difference being per head × 5 = per consumer in most towns. The degree of this influence is again different in most districts, because some undertakings offer free service, free carcase pipes (Beware of Part II.), gas-fittings *ad lib.*, and a large cooker free fixed and no rent. While others put on a big addition to the ordinary price—limit the facilities to meter and one or two fittings on the ground floor, as well as restricting such supplies to houses of a rental under 10s. per week.

Nevertheless, let us consider a few facts which I have compiled regarding this advance in the proportion of slot meters and the loss in the average annual consumption. For the purpose of making a comparison, I take 1901 and 1911, and the following table speaks for itself:—

		Proportion of Slots to Total.		Increase in Slots.
		1901. Per Cent.	1911. Per Cent.	Per Cent.
A	Metropolitan company . . .	41 ..	70 ..	39
B	Birmingham	22 ..	50 ..	28
C	Bristol	17 ..	44 ..	37

The result being that A gains 39 per cent. in slots and drops 35 per cent. in the average annual consumption per consumer. B gains 28 per cent. and loses 27 per cent. in average consumption. C gains 37 per cent. in slots and loses 48 per cent. in average consumption.

Here you have my argument in a nutshell. Who on earth can account for the diversity in the rates of decrease of consumption against the rates of increase of slots without full knowledge of all the points referred to? It is impossible, because of such circumstances and conditions varying in different localities.

I should like to say more on the question of developing the day load; but I fear I trespass far too much on your space, and I will try your patience too much.

July 10, 1912. NONULUS.

Safety in Discharging Oxide Purifiers.

SIR,—I have read with much interest the annual report of the Chief Inspector of Factories, with respect to the danger of emptying purifiers, and your leaderette thereon with the above title, in the last issue of the "JOURNAL."

About this time last year, you will perhaps remember, your columns contained some letters from me upon this subject, in which I gave the result of my experience in ensuring the safety of discharging purifiers, by the simple process of making the foul-box the last taker in the rotation series, for 24 hours before being emptied.

A further twelve months' experience has confirmed my confidence in this practice; but this summer we have taken another step which may prove of interest to your readers. As previously stated, we work our boxes on the backward or forward rotation principle. We admit about 2½ per cent. of air, and we use "Lux" in some boxes and artificial oxide in others. The purifiers are of Green's type, and of about normal capacity. We use "hurdle" grids; and the inlets are at the bottom of the boxes and the outlets at the top.

Whenever it has been necessary to empty a purifier, it has always been from the same cause—viz., an increase of pressure—and we have nearly always found the oxide at the top of the box much the same as when it was put in, while at the bottom it has been caked so hard that it has taken a pick to dislodge it. There is a lot of woodwork at the bottom of the box—viz., the feet of the "hurdle" grids, which are closely packed across the whole area of the purifier, and the layer of horizontal grids supporting them. These, together with the closely-packed oxide with the weight of the superincumbent material pressing it down closely, in addition to the hardening effect of the purifying process, cause the material at this point to cake into a solid mass. I therefore decided this summer to reverse the order, and admit the gas at the top of the boxes and take it out at the bottom. The easiest way to do this was to reverss the boxes over the connections and to fix the ascending box over the inlet and the descending box over the outlet. This was a very easy matter in our case, as all our connections, both inlets and outlets, are on the front of the boxes; but it would not be difficult with any form of purifier.

Everything being in readiness, on June 6 we started on one purifier, keeping the other three in action. This box contained "Lux," and had not been opened since Feb. 13—85,366,000 cubic feet of gas having passed through it in this time. On testing the material, we found it to contain 47·6 per cent. of sulphur and 17·02 per cent. of moisture. Having complete faith in our method of working, I decided to remove only as much of the contents of the purifier as was absolutely necessary to change the inlet and outlet boxes. The work took us a couple of days to accomplish; and after revivifying the material we had removed, we reinstated it, ramming it well down so that it presented about the same resistance to the gas as the rest of the box, and set it working again. We then did the second box, which contained artificial oxide. This was last charged on April 17, since when 34,992,000 cubic feet of gas had passed through it. The material, on being tested, was found to contain 47·82 per cent. of sulphur and 12·01 per cent. of moisture.

We did this box in the same way, and put it to work again. We then had to do the remaining two boxes together, as the inlet of one purifier had to become the outlet of the other, and one new inlet and one new outlet box had to be fixed. One of these boxes contained artificial oxide which had been working since Jan. 14, during which time 129,577,000 feet of gas had passed through it. On being tested, the material was found to contain 47·6 per cent. of sulphur and 8·5 per cent. of moisture. We lifted two of the covers of this box, and two men removed the material and the "hurdle" grids round the connections on the first day, and the second day proceeded to take out the oxide, which had caked hard on the horizontal grids. Upon breaking through the crust of oxide, a rush of gas escaped from the space between these grids and the bottom of the box, and gassed one of the men, who had to be assisted out of the box by his mate, and was in consequence off work for the next two days.

This gas was unable to escape through the caked oxide, although the "hurdle" grids had been removed, and all the remainder of the oxide which had been above it taken out. *This is the danger zone in emptying purifiers. It is quite independent of the kind of oxide employed, and in my opinion can only be overcome by admitting the gas at the top of the purifier instead of the bottom.* Then, when a box is shut off and the plugs removed, all the gas will instantly escape, and the covers can be lifted without any danger, if the box had previously been made the last taker in the series for 24 hours—unless, of course, the top crust is impervious to gas, when it may be necessary to loosen it before the gas can escape. It might also be advisable to admit steam through the inlet to damp the top of the material before raising the lids, if the box had been working a very long time. *Inlets at the top and outlets at the bottom seem to me the necessary corollary of the backward or forward system of rotation in the working of purifiers.*

We met with no further incident. The fourth box, which contained "Lux," and which was last changed on Jan. 23, and through which 120,981,000 feet of gas had passed, proved to contain 41·99 per cent. of sulphur and 18·82 per cent. of moisture. We altered this in the same way, and put these two boxes again to work; and all four boxes are now working as well as ever, though with much less back-pressure—viz., from 1-10th to 8-10ths of an inch respectively.

Wakefield, July 12, 1912. H. TOWNSEND.

Royal Visit to a Gas Worker.—On the occasion of the Royal tour in Yorkshire last Thursday, when the King and Queen spent several hours among the woollen and worsted mills of the West Riding, the procession of cars halted half-way through the village of Slaithwaite, and His Majesty and the Queen alighted at one of the stone cottages The occupier, a gas worker named James Edward Shaw, aged 72, was standing at the door with his lame son and some friends. Their Majesties entered the cottage and questioned the old man about his work, his family, and his daily life; and they pleased him by admiring his little four-roomed dwelling (for which he pays 3s. 6d. a week), and shaking hands with its occupants.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills :—

Bills reported : Birmingham Corporation Bill, Gas and Water Provisional Orders Bill, Gas Companies (Standard Burner) Bill, Shipley Urban District Council Bill, Staffordshire Potteries Water Bill, Water Orders Confirmation Bill.

Bills read the third time and passed : Bognor Gaslight and Coke Company (Electricity) Bill, Dover Corporation Bill, Fleetwood Gas Bill, Gas Orders Confirmation Bill, Ivybridge Urban District Water Bill, Water Orders Confirmation Bill.

The Alkali Manufacturers' Association have petitioned against the Local Government Provisional Orders Bill (No. 10), in respect of the Salford Order.

HOUSE OF COMMONS.

The following further progress has been made with Bills :—

Lords Bill read a second time and committed : Bordon and District Gas Bill.

Bills reported : Llanelly Rural District Water Bill [Lords], Sheffield Corporation Bill, Swanage Gas and Water Bill [Lords], Swansea Corporation Bill.

Lords Bill read the third time and passed : Bawtry and Tickhill Gas and Water Bill.

The Bordon and District Gas Bill [Lords], Water Provisional Orders Bill [Lords], and the Woking District Gas Bill [Lords] have been referred to a Select Committee, consisting of Mr. Hugh Law (Chairman), Mr. R. A. Cooper, Mr. Philip Sassoon, and Mr. John Bethell ; to meet on Thursday.

The London County Council have withdrawn their petition against the South Suburban Gas Bill [Lords], which is now an unopposed measure.

ALKALI MANUFACTURERS AND THE GAS INDUSTRY.

The Contest on the Residuals Question.

HOUSE OF LORDS COMMITTEE.—Monday, July 8.

(*Before Lord* CLINTON, *Chairman, Lord* ELLENBOROUGH, *Lord* SWAYTHLING, *Lord* ELPHINSTONE, *and Lord* BASING.)

SWANSEA AND WEST KENT GAS ORDERS.

As briefly announced in the "JOURNAL" last week (p. 100), the chemical clause was on the previous day inserted by the above-named Committee in the Provisional Order applied for by the Swansea Gas Company, and also in the West Kent Order. We now give a full report of the speeches and evidence. As already explained, both Orders have been passed by the Unopposed Bills Committee of the House of Commons, before whom the question of inserting the chemical clause was thoroughly discussed—a decision being given against the insertion of it on the suggestion of the Board of Trade. Subsequently the United Alkali Manufacturers' Association deposited a petition against the Confirmation Bill, asking for the insertion of a clause identical in terms with that inserted in the South Suburban Gas Bill by Lord Ritchie's Committee early in the session.

Mr. BALFOUR BROWNE, K.C., Mr. C. C. HUTCHINSON, K.C., and Mr. W. W. SZLUMPER appeared for the Swansea Gas Company ; and Mr. J. D. FITZGERALD, K.C., and Mr. MACASSEY for the United Alkali Manufacturers' Association.

Mr. BALFOUR BROWNE said that the Swansea Order empowered the Swansea Gas Company to remove their works to a site outside the town, with the approval of the Corporation. As at present advised, he did not think he need trouble the Committee with the preamble of the Bill, because there was no opposition to it. There was, however, a petition by a certain body of alkali manufacturers ; and as he understood that Mr. Fitzgerald proposed to bring up a clause, perhaps it would be the best plan for him to do this at once, and so shorten the matter.

The CHAIRMAN : I understand this Order is merely for the purpose of allowing you to remove your works from one place to another.

Mr. BALFOUR BROWNE : That is so, and to allow us to do on the new site what we are doing on the old one. I think it will shorten matters if Mr. Fitzgerald will bring up his clause now, and show why it should go in ; and I will then show why it should not. I have not seen the clause yet.

Mr. FITZGERALD said his clause was the same as the one in the South Suburban Gas Bill. He had no objection to the course proposed by Mr. Balfour Browne, as it would probably be the most convenient. He would explain to the Committee the reason for the clause being asked for. The Alkali Manufacturers' Association, for whom he appeared, represented substantially the alkali trade throughout the United Kingdom. The alkali manufacturers found that gas companies and municipalities owning gas-works were relying upon certain general words in the various Acts giving them power to carry on the business of supplying gas in the ordinary way, for the purpose of setting up in business as chemical manufacturers ; and this really was the point at issue in all these cases. It was in this way : The manufacture of gas necessarily produced residual products, which, speaking generally, were coke, tar, and ammoniacal liquor ; and gas undertakers dealt with these in two ways. Some companies sold them, but others worked up the ammoniacal liquor into sulphate of ammonia ; and for this reason it was necessary for them to procure sulphuric acid. This was quite a common thing for them to do, and nobody objected to it. During recent years, however, certain gas undertakers had adopted another process altogether. They bought up chemicals outside, and proceeded to establish themselves in what was really the business of chemical manufacturers, and entered into competition with the ordinary chemical and alkali manufacturer. The Alkali Association was perfectly convinced that it never was the intention of Parliament that statutory bodies like gas undertakers should set up in this way in what was really an outside business ; and when they found the practice was extending—although it had been done in only a very few cases up to the present—they determined, as there were some twenty Gas Bills in Parliament this session, in all of which similar powers were taken, to bring their views before the Legislature. For this purpose they selected four or five cases that they considered typical, and they assumed that, when one or two Committees had given their decision on the point, this would settle the matter.

The CHAIRMAN : I suppose you refer to clause 6. Do you consider power is given to the Company in clause 6 to purchase these things ?

Mr. FITZGERALD : Yes.

The CHAIRMAN : The objectionable words are "deal in," I suppose ?

Mr. FITZGERALD agreed, and said he maintained, with the greatest confidence, that they were never intended by Parliament to authorize the setting-up of gas undertakers in the business of chemical manufacturers. These words, however, had been construed in this manner, and accordingly it had been necessary for the Alkali Manufacturers' Association to intervene. He must tell the Committee what had already happened this session, because he did not think the Association ought to have been put to the expense of this opposition. The matter came before a Committee, presided over by Lord Ritchie, dealing with the South Suburban Gas Bill ; and it was gone into at the very greatest length. He himself brought up a clause for the protection of the alkali manufacturers ; but the Committee were so anxious not to do anything without the fullest deliberation, that, after the evidence had been heard and Counsel on both sides had addressed the Committee, they adjourned for two or three days. When they met again, they inserted the clause for which he was now asking, but which was not as he had brought it up. Although Lord Ritchie made no announcement on the point, he (Mr. Fitzgerald) had not the least doubt—it was the obvious inference—that he adjourned the Committee to consult the authorities of the House.

Mr. BALFOUR BROWNE : Only with regard to the wording of the clause ; not as to whether or not it should go in.

Mr. FITZGERALD (continuing) said, at the time Lord Ritchie's Committee were considering the matter, a Committee of the House of Commons, presided over by Sir Harry Samuel, had before them the Annfield and Fleetwood Gas Bills. This Committee arrived at the same conclusion ; and having been shown the clause adopted by Lord Ritchie's Committee, they also adopted it with slight alteration.

THE CHAIRMAN asked if the two Bills mentioned were in exactly similar terms to the present one.

Mr. FITZGERALD said not exactly, but the principle was just the same. Then the matter arose shortly afterwards on the York United Gas Bill in a Committee of the House of Lords presided over by Lord Barnard. There again the point was discussed at very great length ; and the Committee arrived at the same conclusion. Yet the companies would not accept the decisions of these Committees. For the fourth time, the matter arose on the Birmingham Corporation Bill under identical conditions with those of the Swansea Order. The Corporation were acquiring new land for gas purposes, and the same conditions were in the clause giving them the necessary powers. This was only the previous week before the Duke of Bedford's Committee ; and the Chairman of the Gaslight and Coke Company was called to give evidence in support of the Birmingham proposal. He gave his evidence with his usual perfect fairness ; and, at the end, without calling upon him (Mr. Fitzgerald), the Committee said they were satisfied that they should adhere to the decisions given in the other cases. After these decisions had been given in five cases, one would have thought the gas industry would have been satisfied. In addition, there were at least twelve or fifteen other cases this session in which the promoters had either accepted the clause, or the authorities, in one House or the other, had introduced some clause to the same effect.

The CHAIRMAN : Are the promoters willing to accept the clause in the Swansea Bill ?

Mr. BALFOUR BROWNE : Certainly not.

Mr. FITZGERALD said the Swansea Order was before the Unopposed Bills Committee of the House of Commons. The Alkali Manufacturers' Association were not represented there, but he understood that the promoters gave the Committee to understand that there were a number of small gas undertakings in the neighbourhood of Swansea which could not get rid of their ammoniacal liquor except by selling it to the Swansea Company, and which would otherwise be obliged to let their ammoniacal liquor and tar go to waste. He did not know how far this statement was correct ; but even if it was correct, he did not think it altered the position in the least, because this was the very point made in the York case, and also in that of Birmingham. Obviously, it was no reason at all for allowing statutory gas companies to set up in competition with the ordinary trader. The reason against it was that a gas company was constituted by Parliament for a specific object. The company obtained a monopoly of the gas supply in their district, and this placed them at once in a different position from an ordinary trader. A gas company could raise capital on perfectly easy terms ; and under these conditions it was unfair that they should be allowed to compete with the private trader. This was his case. If the Committee desired, he could call evidence and give reasons in detail ; but it was for Mr. Balfour Browne to show why the decisions already given should not be followed.

The CHAIRMAN : I think it will be better, Mr. Balfour Browne, if you now put your case before us.

Mr. BALFOUR BROWNE said that although Mr. Fitzgerald had told the Committee that a gas company was constituted for a specific object, he had not mentioned that the specific object for which the Swansea Company was constituted, as stated in their Act of last year, was to "sell, provide, and deal in coke, tar, and other residual products, or

refuse, of any materials employed in, or resulting from, the manufacture of gas." Therefore the proposed clause would take away from him what Parliament gave him last year.

The CHAIRMAN: Do you consider that this clause enables you to purchase residuals from outside?

Mr. BALFOUR BROWNE: Absolutely.

The CHAIRMAN: And you consider that it was the intention of Parliament that you should do these things not granted to companies before?

Mr. BALFOUR BROWNE; Absolutely.

Mr. FITZGERALD said he challenged Mr. Balfour Browne to produce a single case where it had ever been suggested that these words gave the powers now being sought.

Mr. BALFOUR BROWNE pointed out that the words "deal in" were in his clause last year.

The CHAIRMAN: Perfectly true; but you are telling us that it was the intention of Parliament to enable you to purchase outside.

Mr. BALFOUR BROWNE said certainly, and he was only asking for the same words now. He contended that this was an entirely unique case. The Swansea Company was a large one. They had a capital of £385,738, made 543 million cubic feet of gas annually, carbonized 42,959 tons of coal, and manufactured 351 tons of sulphate of ammonia. They had for several years paid their full 5 per cent. dividend; and the Committee would hear from the evidence that would be given that there were a number of small companies in the neighbourhood of Swansea who had no sulphate plant, and therefore could not manufacture sulphate of ammonia. The result was that some of these companies had been in the habit of selling their ammoniacal liquor to the Swansea Company, while others had wasted it. But it was a marketable commodity; and if this clause were inserted in the Order, while the small companies would be free to sell, the company having the sulphate plant would not be free to buy. This clause could only be asked for when gas companies came to Parliament. But there were in the country a great number of companies not regulated by Parliament who could buy and sell freely; and the result of this legislation would be to deter any non-statutory company from coming to Parliament at all. The Swansea Company to-day could buy ammoniacal liquor. The same applied to spent oxide; and, as a fact, the Company had been buying it, as well as liquor, from the Pontardulais Company. Sulphate of ammonia was a very valuable fertilizer; and the more of these residual products that could be sold, the cheaper would be the price of gas. In the manufacture of sulphate of ammonia, sometimes copper pyrites and sometimes iron pyrites were used. With gas companies it was the custom to use spent oxide of iron. This was also very largely employed for purifying gas, instead of passing it through lime. This spent oxide was put upon the market at a cheap rate; and it was a very great advantage for those who wished to work up ammoniacal liquor into sulphate of ammonia to get it cheaply. Under the proposed clause, gas companies would be prevented from buying oxide. The Swansea Company would have to give up the manufacture of sulphuric acid, with a consequent increase in the price of gas. Again, with regard to tar, only a few companies had put up distilling plant, or could dehydrate the tar for use on roads.

The CHAIRMAN: I do not think you need go into all the details. This must be settled on a question of principle.

Mr. BALFOUR BROWNE: No; on details.

The CHAIRMAN: Not the details of each particular manufacture. You have led us through the mazes of the manufacture of sulphate of ammonia; need you take us through all the others?

Mr. BALFOUR BROWNE said he would not go any further into these details. He was only asking powers for the Company to do at the new works what they were doing at the old ones; and the proposed clause would take away a power which Parliament expressly gave them last years. There had not been one word of objection to the removal of the works. All Mr. Fitzgerald asked was that the Company should not compete with the alkali manufacturers—a thing which Parliament had given the Company power to do. It was the first time he ever heard Parliament asked to take away a power already given, especially when it was for the purpose of creating a monopoly in the hands of these wealthy alkali manufacturers—some of them, perhaps, the very wealthiest combination in the country. The proposal was absolutely in restraint of trade, and all for the benefit of a ring of manufacturers and at the expense of the people consuming gas. A very important question of principle was therefore raised. With regard to the small companies, he would mention the Clydach Gas-Works, which only made 3,200,000 cubic feet of gas per annum; and all the liquor ran to waste because there was no market anywhere near. The only buyer was the Swansea Company; and the result of the insertion of the clause would be to remove competition for this liquor between the Company and the alkali manufacturers The Clydach Company wanted to sell, and the Swansea Company wanted to buy. It was a source of economy to both Companies that this should take place; and economy was the secret of success, especially with small companies.

The CHAIRMAN: You are not telling us that there is anything different in this case from the other cases already decided

Mr. BALFOUR BROWNE: I am going to deal with each case that has been decided.

The CHAIRMAN: No, no; don't.

Mr. BALFOUR BROWNE: There are only five.

The CHAIRMAN: And you say they differ?

Mr. BALFOUR BROWNE: Absolutely; entirely. Continuing, he said Mr. Fitzgerald had relied solely upon precedent, and had used the argument which he employed in the Birmingham case, that the clause had already been inserted in a number of Bills. But in most cases they were undertakings which did not want to do what the Swansea Company were doing. None of them, in fact, had ever purchased liquor to work up into sulphate of ammonia. Therefore to tell the Committee that this was a justification for putting the clause upon the Swansea Company was to say something that was not quite relevant. In the Birmingham case, Mr. Fitzgerald also used the argument which he himself thought was a good one—viz., that it was a matter of municipal trading. The case of the South Suburban Gas Company was an amalgamation of several Gas Companies, none of which already had the clause.

Mr. FITZGERALD said this was a mistake, as the South Suburban Company had a clause similar to that which was now in the Swansea Order; and the chemical clause was inserted in the Amalgamation Bill.

Mr. BALFOUR BROWNE replied that this was an amalgamation, and under these circumstances clauses were continually conceded which would not be conceded at other times.

Mr. FITZGERALD remarked that it was stated by the Chairman of the South Suburban Company that, though they did not now buy residuals outside, they might wish to do so in the future.

Mr. BALFOUR BROWNE then went on to deal with the Annfield Plain and Fleetwood Gas Bills. He said the latter was not fought at all, so far as the chemical clause was concerned; and as to the former, instead of it being a precedent, the Chairman of the Committee stated that though they thought it ought to go into that Bill, it was not to be regarded as a precedent, but was merely a decision in this particular case.

The CHAIRMAN: Is there a Bill this session in which this clause has not been inserted?

Mr. BALFOUR BROWNE said he did not know of one; but the Swansea Bill went to the Unopposed Bills Committee of the House of Commons, and that Committee refused to insert the clause as the promoters had objected. In conclusion, he reminded the Committee that the words of clause 6, as they were at present in the Order, were identical with those in the Model Bill.

Mr. *George Thornton Andrews*, the Engineer and Manager of the Swansea Gas Company, was then called, and spoke to the Company having purchased ammoniacal liquor from the Pontardulais Gas Company. This Company had, he said, a very small annual make of gas; and there were other small companies in the same position, who were making up to 5 million cubic feet per annum, and who, in the absence of a buyer of their ammoniacal liquor within a short distance of their works, would be compelled to run it to waste. Since the Company's Order had been in the other House, he had had several applications from neighbouring small companies to purchase their ammoniacal liquor. It was his opinion that gas companies should retain the right of free trade in residuals, as otherwise the cost of gas would be increased, and the consumers would suffer, especially in the case of small undertakings.

In cross-examination by Mr. FITZGERALD, witness said that at the time the Bill was before the Committee of the House of Commons the Swansea Company were not purchasing any ammoniacal liquor.

Mr. FITZGERALD: Was not the whole trend of your evidence to the effect that you were purchasing, and that but for your purchase the liquor would be going to waste?

Witness: I did not mean it to be taken in that way. I said we had purchased from time to time.

Counsel then read the report of the proceedings in the House of Commons Committee as published in the "JOURNAL," and witness agreed that it was a correct account of what he said.

Mr. FITZGERALD suggested that the inference to be drawn from Mr. Andrews' previous evidence was that, in the absence of the Swansea Company purchasing the ammoniacal liquor from the neighbouring small gas companies, it would have to be sent to Runcorn or Liverpool. (To witness:) Do you not know quite well that there are chemical manufacturers in South Wales, even in your own town of Swansea, who buy up ammoniacal liquor?

Witness: No; I am certainly not aware of an alkali company in Swansea who buy ammoniacal liquor.

Do you not know that, not only in Swansea but in Cardiff and in Newport, there are alkali manufacturers?—But that is not Swansea.

There are also alkali manufacturers in Bargoed, Swansea, and Cwmbran, in South Wales, who buy ammoniacal liquor?—I say I do not know of any company in Swansea who purchase ammoniacal liquor. Will you name one?

Yes; the Port Tennant Chemical Company.—They do not buy ammoniacal liquor?

Do they buy tar?—Yes.

And your evidence in the other House referred to tar?—Ammoniacal liquor was what I gave evidence chiefly on.

Whom are you buying ammoniacal liquor from now?—We are not buying from any small company at the present moment.

What do the Pontardulais Company do with their liquor?—They sell it elsewhere, but not to us.

Where?—Probably at Cardiff.

They do not sell it to you, or to Liverpool, or to Runcorn?—No.

Why did you conceal this fact when you were giving evidence in the other House?—I concealed no fact whatever.

Surely you said that they would have to send it to Runcorn or Liverpool; but you knew, in fact, that they were selling it at Cardiff? I might have known, but I did not conceal the fact.

Is it not the case that the Cardiff Alkali Company have contracts to buy the whole of the liquor of the Pontardulais Company?—Probably, yes.

And all the other small companies?—I do do not know.

Then how did you come to make that statement in the other House? It was a representation to the Committee that unless they sold to you they would have to send to Liverpool or Runcorn?—It was a general statement in answer to a general question.

You said they would have to throw it away; and at the time you knew perfectly well that the Pontardulais Company had contracted to sell the whole of their liquor to a firm in Cardiff.—I was dealing with the smaller companies generally.

In answer to further questions by Mr. FITZGERALD, witness stated that the Swansea Company purchased liquor from the Pontardulais Company from 1906 to 1908, but had not purchased any since. Probably they had not purchased any from fifteen to twenty years previous to 1906.

The CHAIRMAN said he wanted to find out how the Swansea Company were differently situated from other companies. The fact that there were small companies near did not make it different; and the fact that the Swansea Company could buy, did not make it different. The witness had said he had not purchased since 1908; and apparently, though the Swansea Company had the power, they did not use it.

Witness replied that they used the power when asked to do so.

Mr. BALFOUR BROWNE said there were no small companies near the South Suburban Company; and this made an important difference in favour of the Swansea Company compared with the other.

The CHAIRMAN said he granted that the existence of small companies would make a difference if the Swansea Company could show that they purchased from them. The witness had admitted that they had only purchased from 1906 to 1908, and since that time not at all.

Witness thought there were a few other cases than Pontardulais.

The CHAIRMAN said he did not think this could be brought forward as strong evidence of the difference between the Swansea Company and the others.

Witness said a large number of new companies were springing up along the Great Western line towards Pembroke, and they could not afford to pay the carriage, even to Cardiff, to dispose of their liquor. It was from these companies that the Swansea Company wished to purchase when they had their new works in operation.

Mr. *Percy Player*, Manager of the Clydach and Tawe Tinplate Works, which embraces the Clydach Gas-Works, said his Company at present ran their ammoniacal liquor to waste, because the quantity was too small for them to manufacture sulphate of ammonia from it. He had had communications with the Swansea Company with regard to taking the liquor; and though no definite arrangement had yet been come to, he thought terms would be arrived at eventually. Sulphate of ammonia was used to some extent in his district for agricultural purposes; and it would be a bad thing for farmers if anything were done to increase the price, which it seemed to him must be the case if competition between the gas companies and the alkali manufacturers were removed.

In cross-examination by Mr. FITZGERALD, witness stated that the negotiations with the Swansea Company to which he had referred took place last month; and his gas-works had been in existence for forty years. The works were five miles from Swansea. Counsel also suggested, though witness said he had not made any calculations, that after being carried to Swansea the value of the ammoniacal liquor from his works would be about £12 per annum, and that this would not seriously affect the price of gas. He also got from witness the information that negotiations are in progress for the sale of the Clydach Gas-Works to the Tawe Valley Gas Company, and that if they were successful the Clydach Gas Company would go out of existence.

In re-examination, witness agreed that £12 per annum on his small undertaking would be equivalent to 1d. per 1000 cubic feet of gas.

Mr. *R. G. Shadbolt*, the Engineer, Manager, and Secretary of the Grantham Gas Company, expressed the opinion that the proposed clause was inimical to gas consumers, and would also have the effect of removing competition for the purchase of ammoniacal liquor. The Institution of Gas Engineers had, he said, taken up the question very seriously, and had sent a circular to all the gas undertakings in the country containing a series of questions. [Witness quoted the questions, as given in the "JOURNAL" for April 30 last, p. 280.] This circular went to 1600 undertakings, and 740 replies had been received. They represented 87 per cent. of the total output of gas in the country. Summarizing the replies, witness said that 372 gas undertakings worked up their ammoniacal liquor. Of this number, 353 made it into sulphate of ammonia and 19 concentrated it. As to tar, 76 undertakings worked up or prepared tar in the following proportions: 21 distilled it, 12 dehydrated it for road purposes, and 43 otherwise prepared it for road purposes without distillation. In addition, six undertakings were putting down plant for dehydrating tar. Thus most of the undertakings were in the position of being able to render assistance to small gas undertakings, by relieving them of their residual products. The proposed clause would inflict a great injury to these undertakings, because of the removal of the ability to compete. The summary of the replies also showed that ten gas undertakings which replied manufactured sulphuric acid, and were able to supply others and there were also cases where undertakings were in the position of purchasing spent oxide of iron—the sellers securing better prices on account of competition. One of the most important questions was that relating to purchase from other companies; and the replies showed there were 61 undertakings which, in addition to their own production, purchased residual products from other undertakings. Of these, 57 bought liquid products, such as tar or liquor or both; and the remaining four bought spent oxide of iron. By far the most emphatic expression of opinion was given in relation to the question dealing with competition. In no less than 448 cases, the reply was that there is little real competition for these products, owing to concerted action among the buyers. The replies also showed that at the time of the inquiry there were four cases of actual restriction from dealing in residual products. Two of them were prohibited from using their own products, no doubt due to some special local circumstances; and the other two were specifically prohibited from purchasing from other companies. At the annual meeting of the Institution of Gas Engineers in June, a resolution was unanimously passed condemning the action of the Alkali Manufacturers' Association, as being against the interests of the gas industry, and endorsing the action of the Council in bringing the matter before Parliament. When it was first done this session, people engaged in the gas industry were busy with the coal strike; and they were also taken quite unawares, and did not realize the seriousness of the movement. Since, however, the members of the industry had got together and discussed the matter, a very serious view was taken of it. The replies received to the Institution circular also showed that an appreciable number of gas undertakings were considering the advisability of putting up plant for working up their own ammoniacal liquor. As an instance of what happened when competition was removed, witness mentioned the case of a London company having gone in for the distillation of their own tar, and also purchased it from a neighbouring company who had previously sold to tar distillers. Subsequently the tar distillers regained the company who sold their tar by quoting enhanced prices. This indicated that the absence of competition previously had led to less than the market price being offered.

Cross-examined by Mr. FITZGERALD, witness said he was not aware that there was a shortage of ammoniacal liquor on the market. If there was, it was certainly a wrong policy to place gas companies in the position of not being able to purchase from neighbouring undertakings, and cause the liquor to run to waste. This trade was now being carried on in the Midlands by the Coventry Corporation.

Mr. FITZGERALD: The Coventry Corporation are the notorious sinners, and they have the rates of Coventry behind them.

In re-examination, witness said the whole object of the clause was to prevent competition between the gas companies and the Alkali Manufacturers' Association.

Mr. *W. A. Schultz* gave evidence as to the effect of the proposed clause upon small gas undertakings. He said the Counties Gas Company (of which he is the Managing-Director) contemplated putting up sulphate works at Bicester, which would deal with all the ammoniacal liquor from the Company's other small works in different parts. If this clause were to become general, this could not be done.

The CHAIRMAN: I do not see how this goes to the real facts of the Swansea case.

Mr. HUTCHINSON said he was in hopes that it might have some weight in the Committee's minds if they realized from the witness's evidence what the effect would be upon small companies.

The CHAIRMAN: We are really only trying the point with regard to Swansea. A decision has been given with respect to five companies. Whether or not it should be a precedent, I do not know; but I think you will have to show that the other companies are in different circumstances before you can show that it is not a precedent. I have been trying to get you to show us how Swansea differs from the other cases already decided. I do not think we are going to be advanced by merely saying that some non-statutory company wish to buy, because they are not affected at all.

Mr. BALFOUR BROWNE pointed out that Swansea is surrounded by a large number of small companies, while this was not the case with the companies upon whom the clause had already been put; and it was very important for the small companies to have a purchaser like the Swansea Company to whom they could sell.

The CHAIRMAN: Then how does this witness affect the point?

Witness said he wished to show the importance of the very great hardship that would be inflicted upon small companies who were within reach of a larger company who could manufacture sulphate of ammonia from their ammoniacal liquor, if the company could not purchase from them. It had always been a difficulty to dispose of the liquor; and the price of gas was considerably affected by converting the liquor into sulphate of ammonia either upon the works or by disposing of it to another company for the purpose. The Counties Gas Company intended to come to Parliament for statutory powers; but if this clause were to be inserted in all the Provisional Orders they would have to get, it would prevent the Company from manufacturing the ammoniacal liquor they had taken from the small works to which he had referred.

Mr. *E. H. Stevenson* stated that last year the Swansea Company, for whom he acted, went to Parliament with a proposal for new works. It was strongly contested by the Corporation, on the ground that the site was unsuitable; but Parliament granted the powers, with the clause giving the right to deal in residuals to which reference had already been made. The Corporation, however, were determined, if possible, to obtain the land scheduled by the Company for the purpose of erecting model dwellings; and negotiations took place with the Company immediately after the passing of the Bill. An arrangement was ultimately come to that the Company should give up their original new site, and erect the works right away from residences; and the present Order was the result. He supported the previous evidence that it would be very much more economical for the smaller companies around Swansea to send their liquor to the town rather than to Cardiff, owing to the lower cost of carriage.

In cross-examination by Mr. FITZGERALD, witness said there was no question that the present agitation was started by the Alkali Manufacturers' Association to get rid of their most dangerous competitors. The railway rate for ammoniacal liquor from Swansea to Cardiff was 4s. 11d. per ton, in four-ton loads. But this was the through rate between the two towns; and he did not think the small towns would get such favourable terms.

Mr. FITZGERALD remarked that the rate was 4s. 2d. between Swansea and Cardiff for eight-ton loads.

Mr. *W. J. Rees*, the Chairman of the Pontardulais Gas Company, and one of the Directors of the Swansea Gas Company, said the latter Company were very cramped for room on their present site; and this was the reason why trade in residuals had not been pushed much during recent years. It was the intention to develop it considerably on the new site. The Company looked forward to making far more sulphate of ammonia than they had done in the past; and it was proposed to purchase liquor from small companies with this object. He believed the Pontardulais Gas Company would get better terms for their liquor from the Swansea Company than from the alkali manufacturers. As to railway rates, he pointed out that a large number of the small works would have to send their liquor *viâ* Swansea for Cardiff, if they sold to alkali manufacturers there; and the cost of freight from these small places to Swansea would have to be added to the rate already mentioned from Swansea to Cardiff.

In a very brief cross-examination, Mr. FITZGERALD pointed out that he knew of companies farther distant from Cardiff than Pontardulais who were selling in Cardiff.

Mr. *A. F. Phillips* was the next witness called.

The CHAIRMAN asked if the evidence to be given by the witness would be similar to that which had gone before. If it was, he did not think it would assist the Committee very much.

Mr. BALFOUR BROWNE said he had a considerable number of other witnesses who were intended to prove what he thought had already been proved up to the hilt. They were managers of small works who desired to sell their liquor. They could not find a manufacturer to take it; and they wanted to sell to a gas company. He did not think, however, they could carry the matter further; and under the circumstances, he thought he need not trouble Mr. Phillips.

This was the case against the insertion of the clause.

The room was then cleared. On the re-admission of the parties,

The CHAIRMAN gave the decision of the Committee, which was set out in full last week.

The promoters of the West Kent Gas Order, realizing that the Com-

mittee's decision also governed their case, did not contest the insertion of the clause.

Both Orders, with the clause inserted, were subsequently ordered to be reported for third reading.

GAS COMPANIES (STANDARD BURNER) BILL.

This Bill was passed by the Unopposed Bills Committee of the House of Lords on Wednesday. It provides for the adoption of the "Metropolitan" argand burner No. 2 as the standard test burner for the official testing of the illuminating power of gas supplied by the following companies: Ashton Gas Company, Brierley Hill District Gaslight Company, East Grinstead Gas and Water Company, Folkestone Gas and Coke Company, Gravesend and Milton Gaslight Company, Horley District Gas Company, Portsea Island Gaslight Company, Redhill Gas Company, Rugby Gas Company, Southend Gas Company, Stroud Gaslight and Coke Company, Sunbury Gas Consumers' Company, Sutton Gas Company, Town of Dudley Gaslight Company, and Whitby Gas Company.

Clause 6 of the Bill also stipulates that the County Borough of Portsmouth may provide and maintain, at their own expense, four additional testing-places within a radius of two miles from either the Flathouse or Hilsea works of the Portsea Island Gaslight Company.

The measure has already passed through all its stages in the House of Commons.

CHELTENHAM ELECTRIC LIGHTING ORDER.

The "Bermondsey" Clause Again.

HOUSE OF COMMONS COMMITTEE.

(*Before Sir* FRANCIS LOWE, *Chairman*, *Mr.* RICHARD LAMBERT, *Mr.* THOMAS RICHARDSON, *and Mr.* HERBERT CRAIG.)

The Cheltenham (Extension) Electric Lighting Order was before the above Committee on Wednesday and Thursday of last week; the Order being included in the Electric Lighting Provisional Orders (No. 3) Confirmation Bill. The Order proposes to extend the electric lighting area of the Cheltenham Corporation by including the parishes of Prestbury and Leckhampton, in the Rural District Council of Cheltenham. The only opposition was by the Cheltenham Gaslight Company, who proposed a modification of what is now known as the "Winchester" clause, originally the "Bermondsey" clause.

Mr. JEEVES appeared for the Cheltenham Corporation; and Mr. G. B. RAIKES represented the Cheltenham Gaslight Company.

Mr. JEEVES said that there was no opposition to the preamble of the Order. He then gave a brief statement of the position of electric lighting in Cheltenham, and left it to the Cheltenham Gaslight Company to bring up their clause.

Mr. RAIKES handed in the following clause, which he asked the Committee to insert:

1.—The undertakers shall, so soon as the annual statement of accounts of their electrical undertaking has been filled up in the form prescribed by the Board of Trade under the Electric Lighting Act, 1882, publish in a newspaper circulating in the borough of Cheltenham a notification that such statement of accounts has been filled up, and that copies of it can be obtained at the offices of the undertakers at a price not exceeding one shilling a copy, and such publication shall be in addition to, and not in substitution for, any publication prescribed by the Board of Trade under the Electric Lighting Act, 1882.

2.—The undertakers shall, on the expiration of the third complete financial year after the commencement of this Order, and on the expiration of each third succeeding year, reconsider, and, if necessary, revise, and thereafter maintain, the scales of prices charged for electrical energy under the principal Order, so that, so far as is reasonably practicable, no contribution from the rates of the borough will be required for the purpose of defraying the future expenses of the said undertaking during the next three years: Provided nevertheless that

(*a*) The prices to be charged shall not exceed the maximum prices which may be charged under the principal Order.

(*b*) The scales of price so reconsidered and revised may be from time to time in like manner reconsidered and revised by the undertakers.

3.—Nothing in this section contained shall prevent the undertakers from entering into contracts for periods which may extend beyond the periods at which any revision may take place under the provisions of this section, on special terms, under special circumstances, not applicable to ordinary consumers, but each such contract shall provide that the price to be charged for energy supplied under such contract shall either

(*a*) Be subject to revision at the next triennial revision provided for in this section. Or

(*b*) Vary in the same proportion as the prices charged to ordinary consumers.

Provided that the undertakers shall not, without their consent, be required to accept any price lower than the minimum price mentioned in such contract.

4.—The charge per unit made against the district rate or any other rate in respect of energy used by the undertakers for street lighting or other lighting purposes in any financial year of the undertakers shall be ascertained by dividing the aggregate for that year of the sums referred to in paragraphs (1) and (4) of section 52 (Application of Revenue) of the principal Order by the total number of units supplied or used by the undertakers in that year.

5.—There shall not be made against the district rate or any other rate in respect of energy used by the undertakers for any other municipal purpose, a charge at any higher rate than that made to consumers using energy for similar purposes and for like hours of supply.

Counsel went on to say there were a number of instances in which a clause of this description had been introduced, when it had been a question of adding to an existing area. In connection with the insertion of the clause in the present Order, he emphasized the question of cost of public lighting. Up to the time of the Board of Trade inquiry preceding the granting of the Order, the charge for public lighting had been for some years practically 3d. per unit; but at the time of the inquiry it was reduced to 2·77d. It was his contention that this was far too high, having regard to the cost of generating current for public lighting purposes. Last year the total works costs for the production of the whole of the energy sold for all purposes from the Cheltenham electricity works was roughly 1d. per unit. He would therefore argue that, taking the average works costs of 1d. per unit, and adding (say) ½d. per unit, this would represent an ample figure as the cost which should be charged for public lighting, as the actual cost of production for public lighting would be considerably less than 1d. Last year, for public lighting purposes, there was a consumption of over 600,000 units; and adopting the figure of 1d. for works costs, and adding ½d. per unit to this, gave a profit of £1300 on the public lighting. The clause which he had presented was founded on the Winchester clause, with one modification—namely, the addition of section 4.

Mr. *C. E C. Browne* (of Messrs. Dyson and Co., Parliamentary Agents), said that this clause originated in 1902, as the result of an opposition by the South Metropolitan Gas Company to an Electric Lighting (Extension) Order promoted by the Bermondsey Borough Council, who already had an Order. As a result of this opposition, the original "Bermondsey" clause was inserted, and was made to apply to the whole undertaking.

Mr. JEEVES pointed out that this was an extension Order, adding another portion of Bermondsey to the existing electric lighting area, and did not extend outside the borough, as in the present case.

Witness (continuing) said that in 1904 there were a considerable number of Electric Lighting Orders, of which Maidenhead, Watford, and Huddersfield were all extensions; while seven other ones were originating Orders. As a result of the controversy regarding the Bermondsey clause, the matter was referred to a specially large Committee, presided over by the Duke of Northumberland, with the result that in all the Orders a modification of the Bermondsey clause, which came to be called the "Northumberland" clause, was inserted. This clause provided for revision of prices each five years in the case of new undertakings, and three years in the case of extensions to existing undertakings. This showed that the Committee had given consideration to the question of inserting the clause in Orders relating to extensions of area. In the same session (1904) the Marylebone Borough Council, having acquired by their Act of 1901 that part of the undertaking of the Metropolitan Electric Supply Company within their area, promoted a Bill for, among other things, powers to erect a generating station. This Bill was opposed by the Gaslight and Coke Company, with the result that a clause was inserted substantially in the terms of the Northumberland clause. In 1905, there were nine originating Orders and two extension Orders in which the clause was inserted. He did not know if it was put in after a fight or by consent. In 1906 there was no case in which the clause was inserted. In 1907 the clause was inserted in two originating Orders, in 1908 in one originating Order, and in 1909 in two originating Orders. In 1910, it was inserted in an extension Order—namely, that of the Bath Corporation. In 1911, the Winchester Corporation promoted a Bill for the acquisition of the undertaking of the local Electric Supply Company. This Bill was strongly opposed by the Gas Company, who asked for the Northumberland clause, and the Committee inserted a clause which was an improvement upon it. This improvement was first suggested in connection with a further application by the Bermondsey Borough Council in 1911 for another extension of their area of supply, which was again opposed by the South Metropolitan Gas Company; but a clause was agreed at the local inquiry in the terms of the Winchester clause, although this particular Order was not after all granted. In the present session, the Winchester clause had been inserted in two Orders—Aylesbury and Holmfirth—by the Board of Trade. The policy of the Board, as stated by a leading official, was that they put in the clause where there was no opposition between the parties. Where it was resented, however, the Board would not insert it, but preferred to leave it to a Parliamentary Committee dealing with the Confirmation Bill to settle the matter. The fact that the original Bermondsey clause had been modified from time to time was the reason why the Cheltenham Gas Company now asked for what they considered an improvement upon the Winchester clause; and he admitted that sub-section 4 of the clause was new, and that there was no precedent for it. The main reason for the difference in the clause under sub-sections 4 and 5 was that in Cheltenham there were no other consumers who were comparable with street lighting supply, and therefore without these additions the clause would not give them the protection they desired.

The CHAIRMAN: These clauses have always been inserted at the instance of some gas company?

Witness: Yes, I believe so; but the gas company are not here now *qua* gas company as much as *qua* ratepayer.

They never are?—In other cases, the gas companies opposed the preamble on account of competition; but we do not raise this point now.

It seems rather difficult to separate the two interests in this way. Have no other ratepayers except the gas company raised the question?—I do not know of any.

The CHAIRMAN: It is a curious coincidence that the ratepayer who always opposes is the gas company.

Mr. RAIKES: It is because they are more alive to their own interests than the individual ratepayer.

Witness said it cost money to oppose Bills in Parliament, which an individual ratepayer would not spend. The improvement in the present clause was that it separated the charge for street lighting and other municipal purposes. The old Northumberland clause did not.

In cross-examination by Mr. JEEVES, witness would not agree that the whole object of the clause was to force the electric lighting undertaking to put up the charge to private consumers. All he wanted was by some means to make the electric light undertaking self-supporting. Questions were also put, in cross-examination, to show that, in consequence of the present extension being outside Cheltenham, the subject of street lighting could not arise, and therefore it was unfair to impose the addition as regards the street lighting in Cheltenham itself, which was already in existence. If the supply to the outside area was unremunerative, one obvious course to counteract this was to increase the charge for the public lighting inside Cheltenham. Further cross-examination was directed to show that the effect of sub-section 4 of the clause would be to prevent the Corporation taking into account capital charges in making up the price for public lighting.

Mr. RAIKES (intervening) said that the Gas Company had no wish to hamper the Corporation in any way, and would be willing to have the clause modified, so that capital charges could be taken account of. This had been their intention from the beginning.

Mr. *G. Lloyd Jones*, late Resident Engineer at the West Ham Corporation Generating Station, gave evidence to the effect that, having regard to the hours of supply, and the other circumstances of street lighting in Cheltenham, the charge for public lighting was considerably higher than the average of ten other places of a similar character which he had selected. Load factor controlled the price of all classes of electric supply; and he found that in Cheltenham in 1911, whereas private lighting had a load factor of 9·6 per cent, public lighting had a load factor of 29·1 per cent., and traction 23·8 per cent. In the towns he had selected, he had shown that the charge for public lighting was considerably more than that for traction, although he agreed that the capital charges would be higher on public lighting than on traction supply. Nevertheless, it was his opinion that the charge in Cheltenham, which he calculated came out to about £30 per arc lamp per annum, was excessive.

The CHAIRMAN pointed out that, according to Mr. Jones's own table, all the other towns upon it showed similar increases in public lighting over the charge for traction.

Mr. JEEVES, in cross examination, suggested that Mr. Jones's table was quite useless, as it gave none of the circumstances of the other towns which he compared with Cheltenham. He also put it to witness, who agreed, that in the case of traction supply the traction company bore the cost of distribution, whereas with public lighting and private supply the electric supply authority had to bear this cost. Counsel also pointed out that the present charges for street lighting, which he said were only £21 per arc lamp per annum, *plus* trimming, were those recommended by Mr. James Swinburne in 1904.

Mr. *H. Booth*, of the Board of Trade, in reply to the CHAIRMAN, who asked whether it was the usual practice for the Board of Trade to insert the Northumberland clause in Provisional Orders which simply dealt with extensions of existing areas, said the clause had been settled by a Special Committee appointed by the House of Lords; and the Board had since taken this decision as a direction to insert the clause in all Orders, unless the promoters took exception, whether they were extension Orders or not. In the present case, the Board were not asked by the Gas Company to put in a clause at all before the time of the local inquiry. After the Order had been granted, they were asked to put it in; but the Order was then out of the Board's hands. Unless the Board were asked to put it in, they never did so on their own initiative. If the promoters showed good cause against it, they would refuse to do so, and would leave it to Parliament to decide.

The CHAIRMAN: Do you make any difference on the ground that it is simply an Order for an extension of the area of supply?

Witness: I think the fact that it is an Order merely to extend the area of supply might very well be held to be a good reason against our inserting the clause, and to make it a case which we should leave for decision by a Parliamentary Committee.

And this would apply where it was an extension outside the borough. Would that make a difference?—I think it would strengthen the case against putting in the clause.

In answer to further questions by the CHAIRMAN, witness pointed out the difference in the clause proposed by the Cheltenham Gas Company from the Winchester clause, and was informed that the promoters had expressed willingness to have capital charges included in the price per unit for public lighting. Originally the Gas Company had asked the Board of Trade to insert the Winchester clause.

Mr. RAIKES put a few questions to witness, tending to show that the Board of Trade had always opposed the insertion of the Bermondsey clause in any form in Electric Lighting Orders, and that they only inserted it now more or less under compulsion from Parliament.

The CHAIRMAN hinted to Mr. Raikes that he must not cross-examine witness.

Mr. RAIKES said that he wished to show that, after taking the average costs of production, and adding the ½d. he had suggested, there was ample margin to meet standing charges and prevent the public lighting being carried on at a loss.

Mr. *James Paterson*, Assistant General Manager of the Cheltenham Gaslight Company, said that they paid last year £2000 in rates, which was one-twentieth part of the total collected in the borough. The total cost per mile of lighting the Cheltenham streets by electricity was £503 per annum, which was equivalent to 10¾d. in the pound. There were 383 arc lamps, of which seven were never lighted, and 162 of the lamps were switched off at 10.30 every night. As the total cost of the 376 lamps which were lighted—*i.e.*, excluding the seven—was £9066 per annum, it followed that the cost was over £30 per lighted lamp. The capital cost was about £124 per lamp installe l. There had been a loss of £18,000 upon the Cheltenham electric lighting undertaking up to 1904; and although a small amount had been paid back out of profits in 1904 and 1905, the greater portion of the deficiency was met by raising a special loan.

The CHAIRMAN remarked that he did not see the relevance of this to the point under discussion.

Mr. RAIKES said the evidence was intended to show that there was a very exceptional charge for public lighting, judging by the price per lamp, and that from this it followed that the Electricity Committee had been absolutely inefficient. It was part of his case to ask the Committee to take this into account, and to make the slight variation in the Northumberland clause suggested, in order to put some check upon it. He agreed that they could not find a case comparable with the £30 per lamp per annum charged in Cheltenham.

The CHAIRMAN: I am afraid it conveys very little to our minds unless you can give figures of other places.

Mr. JEEVES having briefly cross-examined witness,

The CHAIRMAN said that the Committee had made up their minds, and therefore did not think it was necessary to call upon Mr. Jeeves to reply. They were all of the opinion that the case for the insertion of this clause had not been made out. It therefore only remained for the Committee to find the preamble of the Bill proved.

Mr. JEEVES then made an application for costs, in view of the vexatious position in which the Corporation had been put by the Gas Company in consequence of their opposition. He had not mentioned this before; but he thought it now right to inform the Committee that the Corporation had offered the Gas Company the Winchester clause, but they would not take it.

The CHAIRMAN said he thought the application was very unusual. Could Mr. Jeeves give precedents for such an application?

Mr. JEEVES said he remembered two or three cases last session in which the application was not only made, but granted.

Mr. RAIKES, in opposing the application, said that Mr. Jeeves had unintentionally misled the Committee with regard to the offer of the Winchester clause. It was quite true that the Company opposed on all grounds at the inquiry, and were largely successful; but they were not so successful as they had hoped in preventing any extension of the electric lighting area. They then proposed to the Corporation that the Winchester clause should be inserted in the Order. They had no reply, and the day for lodging petitions against the Order got nearer and nearer. No answer was received, and the Gas Company were left with no alternative but to lodge the petition. The Corporation, after the petition had been lodged, offered to agree to the insertion of the Winchester clause if the Company would withdraw their petition. In the meantime, however, the Company had inquired into the effect of the Winchester clause, and found that, under the special circumstances in Cheltenham, it would not afford them very much protection; and this was why they proceeded with their opposition.

Mr. JEEVES said he thought he had a right to ask for the costs of appearing on the petition. He could not ask for costs before the petition was lodged.

The CHAIRMAN said that the Committee were of opinion that the Gas Company ought to have accepted the Winchester clause when it was offered after the petition was lodged, and that by not doing so they had put the Corporation to a great deal of expense. The Committee therefore thought the Gas Company should pay the costs from the time they refused the offer of the Winchester clause.

MUNICIPAL GAS BORROWING POWERS,

Parliament and the Limitation of.

The Unopposed Bills Committee of the House of Commons presided over by Mr. WHITLEY, last Wednesday gave consideration to the question of granting unlimited borrowing powers to municipal gas undertakings, in cases where the supply is given outside the municipal area. The point arose in connection with the Local Government Board Provisional Order (Confirmation Bill) No. 9, which dealt with a number of gas undertakings. The point in question, however, was raised on the Newcastle-under-Lyme Order, which, in addition to proposing to grant unlimited borrowing powers, introduced some general provisions relating to modern gas legislation, including the payment of reasonable expenses of delegates to conferences and meetings, and also provided for a Local Government Board audit of the gas accounts.

NEWCASTLE-UNDER-LYME GAS ORDER.

Mr. WOOD (of the Local Government Board) explained the position to the Committee with regard to the borrowing powers. He pointed out that during the past ten years Local Acts of Parliament have been promoted dealing with 23 gas undertakings in which unlimited borrowing powers have been granted; and in fifteen of these cases the limits of supply were beyond the area of the municipal authority. There had been a further 49 Bills conferring additional powers in connection with existing municipal undertakings in which unlimited borrowing powers had been provided for. Of these 49 Bills, 23 related to gas, and in no less than 19 did the limits of supply extend beyond the area of the municipal authority.

The CHAIRMAN said there was no doubt about the recent practice of Parliament. He gathered from Mr. Wood's statement that the Local Government Board took the strong view that it was undesirable to name any sum in such Acts, on the ground of the possible expense of the local authorities in having to come to Parliament again.

Mr. WOOD said the Board held this view very strongly, especially in view of the fact that these local authorities could not borrow any amounts without the Local Government Board's sanction.

The CHAIRMAN asked what was the view of the Local Government Board in regard to outer districts which were within the gas supply area, but not within the area of the municipality supplying gas.

Mr. WOOD said he would prefer Mr. Willis, of the Local Government Board, to deal with the matter, as he was more familiar with it.

Mr. F. J. WILLIS said it was the experience of the Local Government Board that at all local inquiries under these circumstances the outside authorities had ample opportunities to state their grievances; and they invariably came to the inquiry for this purpose. It was no expense to them, and they were able to state their views with such effect that in nine cases out of ten the question was settled on the spot. This was a cheap and effective way of dealing with the matter; and so far as the experience of the Local Government Board went, there was no reason whatever to make any change.

The CHAIRMAN asked Mr. Willis to take a case where a local authority wanted to borrow £50,000 for gas-works purposes. They supplied a neighbouring small authority, who complained that the gas was bad and dear. How would this be dealt with at the local inquiry?

Mr. WILLIS stated that the inspector would allow the small authority to submit evidence on the point.

Sir D. BRYNMOR JONES (a Member of the Committee) asked whether the report of the Local Government Board inspector was made public, so that it could be discussed by the ratepayers, or whether it was simply filed in the office.

Mr. WILLIS replied that as a general rule these reports were not made public; but the inquiry itself was public.

Mr. HILLS (a Member of the Committee) pointed out that the inspector merely went down to see whether the capital was required, and it was only an incidental that outside districts could be heard.

Mr. WILLIS said that the inspectors were always instructed to inquire into any matter concerning the undertaking.

Mr. HILLS: Is there any mandatory order in the Department that the inspectors should hear anybody who came before them?

Mr. WILLIS said there was no technical order, but it was the rule. The notice of the inquiry stated that any person interested might attend and be heard with reference to the subject-matter of it. In answer to further questions, Mr. Willis said that the Local Government Board inspectors had the power to administer an oath, although he could not point to any section of the Public Health Act which enabled them to do this. Probably the authority to do this would come from the Local Act which incorporated the Public Health Act.

The CHAIRMAN: Have you ever had in your experience cases of outside authorities coming to raise grievances at inquiries?

Mr. WILLIS said he remembered the case of an outer authority who were charged 3d. more than the town; and in this particular case it was agreed to abolish the extra charge. In any case of an outer authority making good its point, the Local Government Board could decline to sanction the loan unless the gas authority gave way.

The CHAIRMAN: Can you say of your own actual experience that cases have arisen and have been dealt with in the interests of outer authorities at these inquiries?

Mr. WILLIS replied in the affirmative. The feeling that the inspector would not hear anything because it was not relevant was not correct. The inspectors were definitely told that they must not exclude anything which had any bearing on the matter.

And your view is that this is better than having to come to Parliament frequently?—Yes.

Because where the dispute concerns 1d., 2d., or 3d. per 1000 cubic feet of gas, it may not be worth while promoting a special Order?—Quite so.

Mr. M'LEAN (a Member of the Committee): Have you ever known an outside local authority refused a hearing?

Mr. WILLIS: No.

Mr. MOON, K.C. (the Speaker's Counsel): Supposing an outside local authority brings a good case against a differential price which is being charged, is your only remedy to refuse the capital?

Mr. WILLIS: Yes.

You cannot put into the Order a provision that the differential shall be abolished without the consent of the promoters, whereas an Act of Parliament can?—That is so.

And that is the difference between what you propose, and coming to Parliament each time?—Yes; but experience has shown that our powers are quite sufficient.

Your experience seems to be based on Leeds; and Leeds seems to have acquiesced in the reduction. But I am putting the case where the gas authority refuses to abolish the differential price. Then your only remedy is to refuse the capital, which everybody wants expended?—That is so. But my answer is that it is a perfectly effective weapon.

Mr. HILLS: Under your system, you remove altogether from the purview of Parliament the future conduct of any of these undertakings. You take on yourself the power of Parliament?

Mr. WILLIS: I do not think it quite fair to say we take away the power of Parliament. The intention is that people with a legitimate grievance should have an opportunity of being heard.

It is a permissible opportunity on your part; but in the case of applying to Parliament, there is a mandatory opportunity?—If you could show that there was any foundation for the suggestion underlying your arugment it would be all right; but experience has shown that there is no sort of foundation.

The CHAIRMAN said that his view was as to whether the outer local authorities came freely before the Local Government Board inspector with small grievances, which they would not take the trouble to bring before Parliament.

Mr. WILLIS said this frequently happened; the matters raised being the absence of mains down a particular street, or that there was not a lamp at a particular spot.

Mr. MOON said that surely on the old form of clause, where a sum of money was included, the same position arose, as each particular item of expense had to be sanctioned by the Local Government Board up to the maximum included in the Order.

Mr. WILLIS agreed, but said that the imposition of a maximum sum, after which the authority must come to Parliament, imposed an extra burden of expense.

The CHAIRMAN asked if the Local Government Board found that periodical applications to the Board under the system now proposed was a check on the too rapid expenditure of capital.

Mr. WILLIS replied that it was. He added that, in his view, it was no advantage fixing a sum which it was estimated would carry the undertaking along over a particular number of years, because the local authorities had a perfectly good opportunity of having any matter investigated on the spot by the Local Government Board inspector. This was a cheap procedure, and nothing which tended to bring business to London which could be more cheaply and just as thoroughly carried out in the Provinces should be done.

Mr. MOON: Parliament has in recent years adopted the practice you want?

Mr. WILLIS: Yes. I think Parliament started it.

Do you think that Parliament then had the experience we now have, which is illustrated by the Salford case?—I think the Salford case rather supports me. We pointed out there that the promotion of rival Bills would mean an expenditure of many thousands of pounds, and suggested that they should proceed by Provisional Order, which involved a local inquiry. The result was that at the local inquiry a settlement was come to, and the rival Bills were not gone on with, which saved a lot of money.

After further discussion, the Committee room was cleared. On the re-admission of the parties,

The CHAIRMAN said: The decision of the Committee is that a limit should be inserted to the proposed additional borrowing powers, based on the probable requirements for twenty years; so that after this period it will be necessary to come to Parliament again, in order that any outside authorities may bring their grievances, if any, here.

Mr. WOOD said that he had an estimate showing that the probable expenditure for from 10 to 15 years was £24,000, and suggested that a figure of £30,000 should be inserted in the Bill as the requirements for twenty years.

The Committee agreed to this; and with this addition the Order was reported for third reading.

This Confirmation Bill also included the following Orders, all of which were reported for third reading.

NANTWICH GAS ORDER.

This Order extends the limits of supply of the Urban District Council of Nantwich, and clauses have been inserted for the protection of the Cheshire County Council and the London and North-Western Railway Company.

NEW MILLS GAS ORDER.

This Order provides for the extension of the gas area, and also for differential charges in the outside areas; these charges diminishing as the quantity of gas consumed increases. Clauses have also been inserted for the protection of the Cheshire County Council and the Midland Railway Company.

STRATFORD-ON-AVON GAS ORDER.

This Order authorizes the purchase or lease of the Snitterfield Gas-Works, together with the distributing mains in the parish of Snitterfield. The "Metropolitan" argand No. 2 burner is adopted.

HOLMFIRTH ELECTRIC LIGHTING ORDER.

HOUSE OF COMMONS COMMITTEE.—Thursday, July 11.

(*Before Sir* FRANCIS LOWE, *Chairman, Mr.* RICHARD LAMBERT, *Mr.* THOMAS RICHARDSON, *and Mr.* HERBERT CRAIG.)

This Order, which is included in the Electric Lighting Provisional Orders (Confirmation Bill) No. 3, confers electric lighting powers upon the Holmfirth Urban District Council.

Mr. J. D. FITZGERALD, K.C., and Mr. TYLDESLEY JONES appeared for the Urban District Council; and Mr. A. M. PADDON represented the Holmfirth Gas Company.

Mr. FITZGERALD, in opening the case for the Order, said that it was in the usual form; the main object being for lighting and small power purposes. It was not the intention to supply electricity for power to mills and factories, as the Yorkshire Electric Power Company already had authority for this, and could supply at a much cheaper rate than the Council. In fact, the Council had made arrangements with the Yorkshire Electric Power Company for taking a supply of electrical energy in bulk from them. The Winchester clause had been inserted in the Order by consent. The total capital expenditure was estimated at £5600, and a canvass of the district had already secured promises from 260 consumers. At the local inquiry there were two opponents—one the Gas Company, and the other "dissentient" ratepayers, who were afterwards found to be Directors and officials and friends of the Gas Company. The latter opposition had disappeared; and the only opponents now were the Gas Company, who were opposing on the grounds of competition. He should have thought it was rather late in the day for a gas company to say that a district was not to have electric lighting on the ground of competition; and it was peculiarly so in the present case, because this Gas Company were in a position which he did not believe any other gas company in the United Kingdom were. They were incorporated by Act of Parliament in 1839, and had never been to Parliament since. The result was that they were not subject to any of the General Acts relating to gas companies. Accordingly, there was no limitation of dividend or price. Still more extraordinary was the fact that there was no prescribed illuminating power—the Company could supply any gas they liked. No pressure was prescribed, and they need not give any. There was no provision against impurities, and they could do exactly as they liked. The Company had a monopoly of the gas supply of the district, with all the privileges of a gas company, but none of the obligations or duties which were imposed upon ordinary gas companies. It was perfectly astounding that such a gas company should be in existence at the present day. They had long ago spent their capital; and the result was that there was no money for the extension of the undertaking, unless they took it out of revenue. Moreover, although they had been in existence for 72 years, they had not laid mains through a great part of the district, and certain portions of Holmfirth were to-day lit by oil-lamps, because the Gas Company could not extend their mains. These oil-lamps were within half-a-mile of the works. No consumers had been asked to pay for the mains if they wanted a supply, and any new main laid by the Company had to be paid for out of revenue—in other words, the money came from the pockets of the consumers. To pay for these works out of revenue on the part of a company under the general gas legislation was one of the worst crimes; and it was a little surprising for a gas company of this kind to come before the Committee and say that the inhabitants of the district, who wanted electric light, should not have it lest there was

competition with the gas company. The Company had been given the Winchester clause. He did not know what more they wanted.

Mr. PADDON pointed out that the period for revision in the clause was five years, whereas in Winchester in was three years.

Mr. FITZGERALD (continuing) said that this was because it was a new undertaking—it having been laid down by the Duke of Northumberland's Committee that five years should be the period in the case of a new undertaking, and three years for extensions of existing undertakings. The Gas Company, in their petition, asked that the maximum price in the Order should be made 8d. per unit instead of 6d., which was the usual price. He reminded the Committee that if this alteration were made it would seriously affect the whole scheme, as the 260 consumers who had promised to take a supply had done so on the basis of a maximum of 6d. It was also asked in the petition that the Council should be compelled to transfer the undertaking to a company—a proposal which he had never yet heard of, although it was quite true that when an Electric Lighting Order was granted to an individual he was compelled within a certain period to transfer it to a company.

The CHAIRMAN asked Mr. Paddon to what extent his opposition went, in order to make the position quite clear.

Mr. PADDON, in reply to this, said that he opposed the Order lock, stock, and barrel.

Mr. *Thomas Brooke*, a member of the Holmfirth Urban District Council, gave evidence as to the desire of the inhabitants for electric light, and spoke of complaints with regard to the gas. A poll of the ratepayers on the subject of electric lighting resulted in 1283 voting for it and 582 against, out of a total register of 2423 voters. Arrangements had been made with the York Electric Power Company for current, with a maximum price of 1d. per unit. It was proposed to have 350 street-lamps under the new scheme. At present the gas lighting cost £430 per annum. The new electric lighting scheme comprised 150 more lamps than at present, with double the candle power, for the same price.

In cross-examination by Mr. PADDON, witness argued that the Gas Company had never without assistance done anything to improve the lighting of the district. For instance, they had on one occasion asked for a guarantee of 10 per cent. for five years, when requested to lay a main. Counsel put it to witness that the present method of lighting in Holmfirth was that the Gas Company supplied the gas and the Council did the cleaning, and that a tender by the Gas Company for a new scheme at a lower price than at present, and giving 19,000-candle power against 17,500-candle power (the Gas Company carrying out the whole of the work), had not even been considered.

The CHAIRMAN, in connection with several further complaints by witness of the Gas Company asking for a guarantee upon the cost of new mains, said that it was a perfectly natural thing to ask for a reasonable return on the outlay for a certain period until they secured custom.

In further cross-examination, witness said that the public lighting cost was about £2 per lamp per annum, which Counsel suggested was not a very high figure. It was also stated that Mr. W. B. Woodhouse, the General Manager of the Yorkshire Electric Power Company, had said that the cost of wiring houses for electric light would be from 8s. to 10s. per point, whereas the Gas Company were doing it for 2s. 6d.

The Committee adjourned until yesterday.

Metropolitan Water Board's Deficits.

This subject was to have been considered at a special meeting of the Metropolitan Water Board last Friday, on a motion by Mr. C. G. Musgrave, the Chairman of the Appeal and Assessment Committee—"That the Finance Committee be instructed to issue precepts upon the constituent authorities, as provided by section 15 of the Metropolis Water Act, 1902, to meet the deficiencies in the water fund for the years ended March 31, 1909, 1910, 1911, and 1912 respectively, and also the estimated deficiency for the year ended March 31, 1913." The Chairman of the Board (Mr. E. B. Barnard) said the matter had already been before the Finance Committee, who would be meeting again on the following Monday to fully consider the report of the officers. In view of this, Mr. Musgrave withdrew his motion till the next meeting of the Board, which will take place on the 26th inst.

Carlisle Gas Undertaking.

The past year's accounts of the Carlisle gas undertaking, which were submitted at last Tuesday's meeting of the Town Council, showed a gross profit of £13,845, and a net profit of £8552. It was stated that the Gas Committee had passed the following resolution: "That the suspense account, amounting to the sum of £1923, be paid off out of the profits for the past year; that the deficit on the baths for the year, amounting to the sum of £599, be also paid out of the profits, and that the balance be paid to the city fund." Mr. Burns, in moving the adoption of the report, said the accounts showed that they had had another good year at the gas-works. After providing for everything, there was a surplus of assets over liabilities to the extent of more than £127,000. This spoke volumes for the management in past years; and he was confident there were very few gas undertakings in the kingdom that were in such a splendid position financially as the Carlisle Gas-Works.

Cheaper Gas for Cobham.—The Leatherhead Gas Company's Bill for the acquisition of the Cobham Company's undertaking received the Royal Assent on June 25; and the Company announce that, as from the midsummer quarter, the price of gas will be reduced from 5s. to 4s. per 1000 cubic feet. At Byfleet a main has just been laid alongside the footbridge spanning the Brooklands track, so that the Company's gas will now be used for lighting the workshops of the aeroplane works, and also for driving gas-engines for hardening machines. The Cobham Parish Council have recently accepted the Company's tender for lighting the public lamps from September to April during the next three years.

LEGAL INTELLIGENCE.

SHAREHOLDERS' RIGHTS TO BACK-DIVIDENDS.

In the Chancery Division of the High Court of Justice last Wednesday, Mr. Justice Parker had before him a special case stated to get the opinion of the Court as to the respective rights of three classes of ordinary shareholders in the South Essex Water Company in respect of the profits which in any year were available for distribution by way of dividend after the dividend for each year on all the ordinary stock at the rate prescribed by the Water-Works Clauses Act, 1847, and the Company's Special Act had been paid in full. The Company was incorporated by an Act of 1861, under which there were issued 8000 shares of £10 each; and as no rate was prescribed, the 10 per cent. specified by the General Act applied. In 1882, the Company exercised the borrowing power conferred upon them by the Act of 1861, and issued further shares to the nominal amount of £5700. Under the later Act, there was an issue of £75,000 of stock, with a prescribed rate of 7 per cent.; and under an Act of 1901, an issue of £132,500, with a prescribed rate of 5 per cent. Up to June 30, 1911, with one or two exceptions, the maximum rate of dividend was not paid on any of the stock. On that of 1861, there was a deficiency equal to £199,746; on the 1882 stock, to £10,182; and on the 1901 stock, to £2855. The Court was asked to say how the undivided balance in hand should be apportioned between these different classes of stock.

Mr. TOMLIN appeared for the plaintiffs. The defendants were represented by Mr. MARTELLI, K.C., and Mr. BRYAN FARRER; Mr. ROMER, K.C., and Mr. HOWARD WRIGHT; and Mr. GRANT, K.C., and Mr. GEORGE RASHLEIGH.

His LORDSHIP held that the case was on all-fours with that of Weymouth [reported in the "JOURNAL" for Feb. 21, 1911, p. 536], where the Court held that, in making up the deficiency, the Company were bound to preserve, between the total amounts paid by way of back-dividends to the holders of the different classes of capital, the proportions prescribed by section 75 of the Water-Works Clauses Act, 1847, and the Special Act as the maximum dividend on the different classes of shares respectively until the arrears were paid. He accordingly made an order to this effect, and directed the Company to pay the costs of all parties.

RATING OF LICENSED PREMISES FOR WATER SUPPLY.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Wednesday, July 10.

(*Before the* MASTER OF THE ROLLS, *and Lords Justices* FARWELL *and* KENNEDY.)

Metropolitan Water Board v. Phillips.

This was an appeal by the defendant from the judgment of Mr. Justice Parker, delivered on the 20th of December last, and raised an important point under the Water Board (Charges) Act, 1907, in connection with the rating of licensed premises.

The Water Board brought the action against defendant, as occupier of the "Brown Bear," in Aldersgate Street. It appeared that in 1908 the valuation list then in force was altered by a supplementary list, in which the rateable value of the premises was put at £400. The supplemental list came into force on April 6, 1909; and the case for the Board was that it was upon the rateable value therein stated (£400) that the water-rate for the quarter from Oct. 1 to Dec. 31, 1910, was to be calculated. On June 2, 1910, the Overseers sent to the Assessment Committee, pursuant to section 47 of the Valuation (Metropolis) Act, 1869, a provisional list, in which the rateable value was put down at £399; and on June 23, 1910, the Clerk of the Committee served on the defendant, as the occupier of the premises, a copy of the part of the provisional list relating to them, with a notice stating the day on or before which he could object to the list. On Oct. 3, 1910 (two days after the beginning of the water quarter), the Assessment Committee considered the provisional list, and reduced the rateable value to £234; after which the list, properly signed, was returned. In these circumstances, it was contended that the provisional list formed part of the list at the commencement of the quarter from October to December, and the water-rate for the quarter was to be calculated upon a rateable value of £234, instead of £400. Mr. Justice Parker came to the conclusion that the list referred to in section 13 of the Board's Charges Act was the original list in existence on the first days of the water quarter, unaltered by any provisional list, unless the latter had then been completed, after any objection had been taken before, and determined on by, the Assessment Committee. Judgment was accordingly entered for the Water Board, with costs. From this the defendant appealed.

The MASTER OF THE ROLLS read a judgment in which, after reviewing the position of the Water Board under their Charges Act, and summarizing the provisions of the Valuation (Metropolis) Act, 1869, bearing upon the case, he said: The question before the Court is, What was the valuation list in force on Oct. 1, 1910? On the one hand, it is said that on that date it was the supplemental list unaltered which alone was in force. On the other hand, it is said that the provisional list forms part of the valuation list for the time being in force, having regard to the retrospective effect given to the provisional list. Mr. Justice Parker held that the former view is correct, and I agree with his judgment. When it is remembered that the water-rate is payable in advance on the first day of the quarter, it seems to me to follow that it must be possible on that day to ascertain the amount payable, and that it cannot be reasonably held that the obligation of the consumer depends on the subsequent action of the Assessment Committee. It is not easy to say how the Water Board can estimate

* See "JOURNAL," Vol. CXVI., p. 923.

the amount of the rate (not exceeding 5 per cent.) which they require, unless they know the total amount of the rateable value of the property supplied with water. The provisions of section 45 of the Act of 1869, as to qualifications, seem to tend to the same conclusion. I am also impressed by the consideration that there is no provision for refunding any amount overpaid before the provisional list has been made, or, on the other hand, for requiring a further payment where the rateable value is increased by the provisional list. On the whole, I think Mr. Justice Parker's decision is correct, and that this appeal should be dismissed; but as my colleagues take a different view, the appeal will be allowed.

Lord Justice FARWELL also cited and commented upon the provisions of the Act of 1869. Coming to section 47, he said: The object of this section is to substitute the new value for the old as from the date of service specified in sub-section 3—in this case June 23; and this then becomes, as from that date, the true valuation list as provided by sections 43 and 44. The result is that at the beginning of any current year of rating there is no valuation list that can be regarded as indefeasibly and unalterably in force. It is open to variation by the retrospective action of section 47. This being so, what is the meaning of "the valuation list in force at the commencement of the quarter for which the water-rate accrues" in section 13 of the Water Board's (Charges) Act? Is it a sum acertained merely by referring to the valuation list as appearing on that date, or is it the valuation list which is really and legally in force by virtue of the retrospective provisions in section 47 of the Valuation (Metropolis) Act, 1869? The water-rate is assessed on rateable value. The Board have the advantage of being authorized to demand payment in advance; but this ought not to entitle them to retain a larger sum than was in truth due to them, as shown by the subsequent order of the rating authorities. This is not only fair and just, but is in accordance with the words of the Water-Rate Definition Act, 1885, mentioned in the last paragraph of section 13. The rateable value is "as settled from time to time by the local authority as duly constituted." The rate has been in this case so settled, by relation back, that on Oct. 1 the rate settled on Oct. 3, became the amount. If this is not so, the provisional list is excluded from the operation of section 13, and the words in the Act of 1885 must be read with the addition "as settled from time to time by the quinquennial or supplemental list but not provisional list." I cannot bring myself to think that this is the true construction of the Act; and I think the appeal must be allowed.

Lord Justice KENNEDY concurred.

The appeal was accordingly allowed.

The Cowdenbeath Gas Company Shares Litigation.

The Judges of the Second Division of the Court of Session in Edinburgh on Saturday gave judgment in a reclaiming note by James Hutton, of Polworth Terrace, Edinburgh, in the action against him by Alexander Waddell, Gas Manager, of Dunfermline, and Forbes Waddell, of South Queensferry, for payment of £1000 as compensation for loss they had sustained through the failure of Mr. Hutton to inform them of an additional allotment of shares in the Cowdenbeath Gas Company, in which they were shareholders. In the Outer House, Lord Ormidale found the defender liable in payment of £757 10s., with 5 per cent. interest from June 4, 1908. The defender reclaimed; and the Judges of the Second Division, while agreeing with the Lord Ordinary that it was the duty of the defender to have informed the pursuers that they were going to allot additional shares, have disagreed with him in finding that they could have raised money to pay for the shares if they had been allotted to them. They therefore reduced the compensation to £250. The pursuers get their expenses in the Outer House; but no expenses are found due to or by either party in the Inner House.

Sequel to a Gas Explosion.

In the Glasgow Sheriff Court a few days ago, Sheriff Taylor found the Corporation of Glasgow liable in £25 damages to Mrs. Sarah Watson or Sinclair, of Duke Street, Glasgow, in respect of nervous shock sustained by her in consequence of an explosion of gas which took place on Oct. 9, 1911, while Corporation workmen were renewing part of the gas-piping. The Sheriff found that during their operations the workmen turned on the gas to test the new piping, and kept it on for five minutes. Five or seven minutes after the gas was turned off, an explosion occurred, which caused damage to various parts of the tenement. The explosion was due to gas escaping from a worn piece of piping, the defective condition of which was due to corrosion by soapy water, used in washing the first landing, percolating from it on to the pipe. In his note, the Sheriff said defenders premised the skill of a tradesman; and it seemed to him that if they caused a leak in circumstances where they should have foreseen that their operations were likely to do this, they were liable, no matter how the gas was ignited.

Rochdale Corporation's New Reservoir and its Cost.—It is not expected that the construction of Rochdale's new reservoir at Buersil will be completed until October of next year; and the Water Committee now recognize that the reservoir is to cost considerably more than the original estimate, which was £14,400. The extras already amount to upwards of £2000; and more expenditure is looked for under this head. Much of the additional cost to date has been incurred in consequence of the erosion following the cessation of operations when the original contractor relinquished the task, with the consent of the Council—some time elapsing before the Corporation could continue the work. Up to the Corporation taking over the contract, £420 had been paid to the original contractor for extras. Additional expense has also been entailed on making the footings on the bottom of the reservoir wider than was at first proposed. They are now 5 ft. 6 in. wide and 2 ft. 6 in. deep; the cost being increased from £350 to £1017.

MISCELLANEOUS NEWS.

THE ILKESTON GASHOLDER AND TANK DISASTER.

Conclusion of the Inquiry—Further Expert Evidence.

Mr. A. G. DRURY, M.Inst.C.E., one of the Engineering Inspectors of the Local Government Board to whom had been delegated the duty of conducting the investigation directed to be held by the Home Secretary, under the provisions of the Factory and Workshop Act, 1890, into the "causes and circumstances" of the explosion which took place at the Ilkeston Corporation Gas-Works on Jan. 8 (when a girl named Gough was drowned in the water which escaped from the demolished tank), concluded his inquiry at the Ilkeston Town Hall on Tuesday last. When the proceedings were adjourned on June 19 [see "JOURNAL," June 25, p. 995], after occupying two days, it was somewhat problematical whether any additional evidence would be tendered—the Inspector intimating that he should leave the matter open, and call further witnesses if he deemed it requisite. The important feature on Tuesday last was the expert testimony afforded by Mr. W. Doig Gibb, the Chief Engineer of the South Metropolitan Gas Company, who had been called in specially by the Home Office authorities. Most of the principal professional witnesses who had attended the previous sittings were again present.

Mr. W. J. WAUGH, K.C., with whom was Mr. J. J. JEEVES (instructed by the Town Clerk, Mr. S. F. James), appeared on behalf of the Corporation; Mr. GRAHAM MILWARD, (instructed by Messrs. Pinsent and Co., Solicitors, of Birmingham) represented Messrs. C. & W. Walker, Limited, of Donnington, Salop, the makers of the holder and tank. The inquiry was also watched by Mr. C. R. PENDOCK, H.M. Inspector of Factories for the Derby District.

Mr. *F. C. Humphrys*, the Engineer of the Ilkeston Gas-Works, who was re-called and examined by the INSPECTOR, said he thought the gas caught alight through sparking in the inner lift. Witness expressed his conviction that the ladder came in contact with the top of the lift. The sparking took place outside the holder. He agreed that sparking within the holder would not cause explosion in undiluted gas. The sparking which he thought took place occurred on the lip of the holder. The rollers were not worn unduly, but some of the pins were, he noticed after the explosion, bent. The rivet-heads were all intact, and had not come in contact with the rollers. The rollers and carriages were all in proper adjustment. So far as he could tell, therefore, the working of the holder was quite in order. The seal between the inner and the outer lifts had been examined regularly when the holder was down. In the winter time, when the holder was up, there would be examination made at the higher level. There was danger under certain circumstances of the water draining off, but he had not seen any evidence that it occurred in this case. The lift might sometimes not be down for a week or a fortnight, and in the interval no examination would be made. The lower lift was dinted at the bottom edge. There was, he found, a corresponding dint in the inner lift. The dint, he thought, was caused by coming into contact with the contiguous wall which was demolished. He agreed that this view was not possibly correct, as the wall must have gone before the gasholder reached it. He could not, however, account for the dint in any other way than that which he had suggested. There must obviously have been great force. When the concussion took place, the two lifts telescoped. He did not know of anything except the wall with which the holder could have come in contact. He did not think the side of the tank could have been thrown over the wall.

Mr. WAUGH suggested that the dinting of the holder was caused by it coming into contact with the tank, which had not sufficient force in itself to carry down the wall.

The INSPECTOR thought the wall must have been swept out of the way before the holder came up to it.

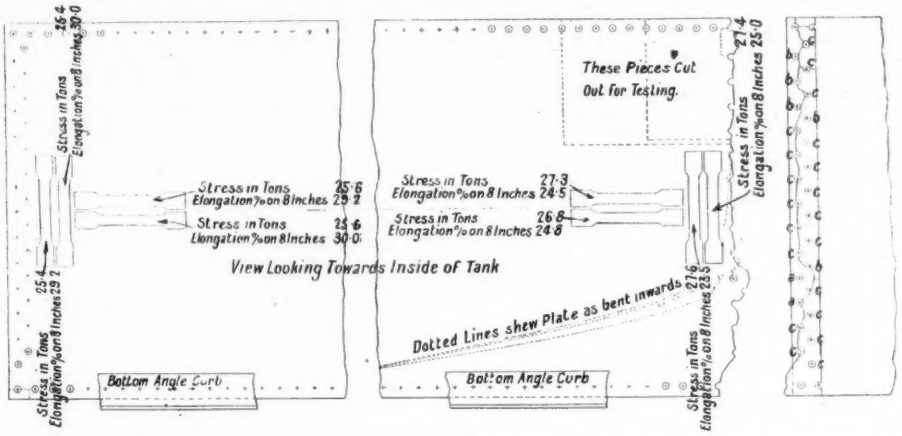
Witness added that there was a centre-pillar which was not carried away.

The INSPECTOR said circumstances pointed to the side of the tank being thrown over the wall.

Witness agreed that this was a reasonable view of the position. He added that extensive renewals would be necessary in connection with the damaged holder. Several of the joints were deformed and twisted by the fire. The whole of the tank plates had been removed to Messrs. Walker's works.

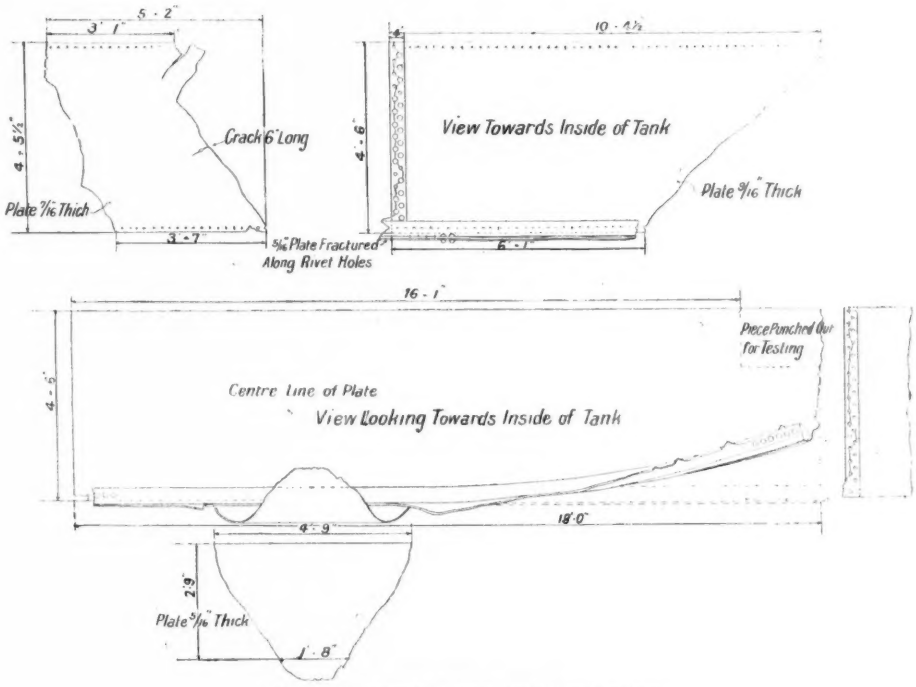
Mr. MILWARD said he believed that some of the plates were sold locally.

Mr. *J. Ferguson Bell*, M.Inst.C.E., Engineer of the Derby Gas Company, produced plans of tanks erected under his direction at Burton and Belper. The factor of strength allowed for in the former case was 3·76 for the tank, with the outside guide-framing to take the wind pressure; and at Belper, where the tank was exposed under similar conditions to those at Ilkeston, the factor allowed was 4·4. He produced a table showing tests on the 9-16ths inch bottom side plate. An analysis of the steel in the damaged tank had been made for sulphur and phosphorus The sulphur percentage was 0·050, which was normal at one place; but 0·100 for basic Bessemer steel represented the test for phosphorus present, which was distinctly high—pointing to brittleness of the plate. Impact tests were taken across the grain and against the grain; the figures, as shown by the diagram, being rather on the low side. His plan corresponded practically with the tracing which had been put in by Professor Adams. Professor Adams had said he took the fracture as having passed through the outer plate of the lap. The narrow width of the plate at the joint was torn away in the course of the accident, some rivets having given. There was fracture of the inner plate at the joint. He had portions of the plate left.


These Pieces Cut Out for Testing.
Stress in Tons 25·6 Elongation % on 8 Inches 29·2
Stress in Tons 25·6 Elongation % on 8 Inches 30·0
Stress in Tons 27·3 Elongation % on 8 Inches 24·5
Stress in Tons 26·8 Elongation % on 8 Inches 24·8
View Looking Towards Inside of Tank
Dotted Lines shew Plate as bent inwards
Bottom Angle Curb
Bottom Angle Curb

Position of Test-Bars and Line of Fracture of Bottom Side Plate in Tank—Plate 18 ft. by 4 ft. 6 in. by $\frac{9}{16}$ inch thick.

NOTE.—Two Rivets marked "a" Sheered off.
Five " " "b" Nobbled heads torn off and were pulled out.
Twenty " " "c" Intact.


Crack 6" Long
Plate 7/16 Thick
5/16 Plate Fractured Along Rivet Holes
View Towards Inside of Tank
Plate 9/16 Thick
Piece Punched Out for Testing
Centre Line of Plate
View Looking Towards Inside of Tank
Plate 5/16 Thick

Details of Fractured Plates—Scale ½ inch to foot.

[Reproductions are given of two drawings put in by Mr. Bell at the Inquiry. The first shows the $\frac{9}{16}$-inch bottom side plate at the point of fracture. The second drawing is given to show clearly the fractured plate after the accident. The tank opened outwards, as shown in the sketches and photos that have already appeared in the pages of the "JOURNAL."]

The INSPECTOR thought it would be desirable that they should be produced for examination. Mr. Bell's view was that the crack did not go through the two plates. It would be a very extraordinary thing if it did.

Replying to further questions by the INSPECTOR, witness said it was no doubt possible, if the holder "lurched" down, that there might be such friction as to cause sparking and ignition of the gas; but this must have occurred outside the holder, where an explosive mixture had been formed. This was a possible explanation of the accident. There was the suggestion, also, as to the light from the neighbouring house, referred to previously in the evidence, having caused the explosion; but in that case the gas would have had to travel a considerable distance. There were incandescent burners near, but they had no bye-passes.

Mr. MILWARD said that an independent examination of the plate for phosphorous, on behalf of the makers of the tank, gave the figures as 0·078.

Witness pointed out that his examination was made of the bottom plate.

Mr. MILWARD replied that the plate which Messrs. Walker had submitted for examination was taken at random.

The INSPECTOR said figures as to the actual shearing strength of the rivets had been promised.

Professor *Henry Adams* said the joint was weak in the shearing strength of the rivets. He gave some reasons on the last occasion as pointing to the probability of the rip of the tank being from the top. He had been since informed that the heads were not off the rivets, and this would be practically conclusive of the sort of movement which witness illustrated by tearing in two from the top a piece of paper.

Mr. *Humphrys*, re-called, said he believed some of the rivet-heads were off.

Professor *Adams* said that what he had mentioned accorded with the idea that the crack did not go through both plates. The inner plate broke away from the inner rivets.

The INSPECTOR: That, however, hardly corresponds with your theory.

Witness remarked that the mischief was caused by a tear.

The INSPECTOR: You had better examine the plate in company with Mr. Bell and myself.

Witness further said that, except under a blow, he did not think the phosphorus in the metal would have any bearing on the matter of the accident. Five tons was a safe stress to take in shearing rivets. He had said this in certain text-books which he had written. He still thought 10 tons would be high.

Mr. *R. J. Milbourne*, of Messrs. C. & W. Walker, re-called, said the factor of safety in tanks designed by his firm varied considerably; some of the figures being 3·1, 3·3, 3·7, and 3·8. In one case it was 4. The competition with other firms had a great deal to do with regard to reducing the figures. The centre plate gave the margin of safety—they considering that the bottom curb gave enormous strength. The bulk of the specifications for work of this character were supplied by the firm themselves; independent specifications being generally furnished by the engineers for large holders of over 150 feet diameter.

The INSPECTOR observed, as to the factor of safety, that the low figure of 3·1 was for a guide-framed holder.

Mr. MILWARD replied that this was not so. One of the lowest was for a spiral holder, approved by a leading engineer.

Witness, replying to further questions by the INSPECTOR, said he

thought that 3·5 was as low as they ought to go as a factor of safety, and he should have no hesitation in adopting this standard.

Other witnesses engaged at the scene of the explosion were afterwards called.

William Winfield described the great onrush of water which followed upon the bursting of the tank, and which necessitated him taking refuge upon the coal-heap. He said the water was 4 or 5 feet high. He did not until afterwards see any light coming from the direction of the damaged holder.

William Pierrepont said he was tipping coal at the time of the accident. He heard a ripping noise coming from No. 3 holder, and flames were then rising from the holder. He also took refuge on the coal-heap before the water came. The holder was then up, but not to the full extent. The top lift seemed to be rocking, and the flames flashed from one side to the other as the rocking went on. It appeared to be lowering as it rocked. He did not notice whether it was revolving. All this time water was rushing from the broken tank, until it got up to the level of the coal. The water at first seemed to be squirting out two sheets from the top of the tank, which afterwards collapsed altogether. One side of the tank came up to the wall of the house in Belfield Street; but he did not see whether it knocked the wall down, as everything happened so quickly. The flames came from between the two lifts. The tank seemed to open out from top to bottom.

In answer to Mr. WAUGH, witness said the flames rose to a great height. The bottom part of the tank appeared to tear outwards.

By Mr. MILWARD: The tank seemed to rip from the bottom. He did not see the water bubbling over the top of the tank. It came from a point two sheets down.

Eli Kirk, engine-driver at the gas-works, said that at the time of the accident he was in the mess-room. He heard a report, and on going to the door saw a light on No. 2 holder. There was a great rush of water, which was observable before the light could be seen. He could not see what caused the flame on No. 2 holder. Only half-a-minute elapsed before he heard the report and saw the rush of water. It was probably a minute later that he saw the flames from No. 2 holder.

The INSPECTOR: A minute is a long time.

Witness agreed that the flames might have been observable almost immediately after.

Mr. MILWARD: No doubt, it was a question only of seconds.

Witness: It might have been half-a-minute. He agreed that it all occurred so suddenly that he could make no exact statement as to the extent of the period between hearing the report and afterwards seeing the flames.

John Hallam, another employee at the works, gave a somewhat similar narrative.

Mr. *W. Doig Gibb*, M.Inst.C.E., Chief Engineer of the South Metropolitan Gas Company, who was next called, at the instance of the Home Office, said he had had experience of the construction and working of gasholders. He had had experience of steel tanks below ground, of spiral holders in brick tanks, but not of spiral holders in steel tanks. He had, however, gone through calculations about the latter with friends. He had prepared specifications for spiral holders and also for steel tanks for standard holders. He had every confidence in spiral-guided gasholders, which had on all occasions proved their strength against gales. He believed that this type of holder was quite safe, and that any engineer would be justified in accepting it. He had always found they worked well—theoretically they should, and practically they did. He had no knowledge of spirally-guided holders having become altogether jammed, but he had of partial jamming. Difficulties had occurred in the earlier stages of the introduction of these holders, but had since rapidly disappeared. There ought not to be any fear of undue jamming, if proper supervision was exercised. The type of holder made by Messrs. Walker worked well, though it might perhaps be improved upon. Steel tanks for spiral holders should be stronger than for holders with guide-framing. He had designed tanks for guide-framed holders, and thought the factor of safety should be at least 4; but for tanks above ground it should be more. He had considered the strength of the tank in this case, and thought that immediately below the top curb it might have come down as low as 2·04. If they considered the matter properly, they could work it out that there was in this case only a margin of safety at one point of about 2. There was a stress or shear at the point indicated, of the equivalent of 14 tons per square inch on the net area of the metal. He had read all the evidence in the case, and had sought for the cause of the accident. He looked first for a natural cause, apart from the suggested jamming. He generally agreed with Mr. Bell's figures as to the calculations of tank strength. In Continental practice, engineers allowed 41 lbs. to the square foot for wind pressure; but in England the general allowance was 28 lbs. Calculating the holder to be up to the very top, though not at the time of the accident, there might, at some time, have been a strain on the top curb to the extent of 22 tons per square inch. Probably when the accident occurred, the top curb was not as it was when it left the manufacturers, the metal, by over-straining, having been reduced in its power to resist the strain. Then there was the fact also to be borne in mind that the lower plates were made of basic Bessemer steel, and there was more chance of there being brittle spots or areas in them than if they had been made by the Siemens or other open hearth process. In connection with the behaviour of brittle plates, much depended upon the temperature. He believed that there had been a great range of temperature on the day of the accident—18° of frost at night, followed by a rise to 60° in the day.

The INSPECTOR said that apparently there had been something like 7° of frost.

Witness (continuing) said that the point which impressed him most was the secondary crack on the other side of the bottom plates of the tank from the main fracture, pointing to extreme brittleness and unreliability. He had heard what had been said as to the composition of the plates, and agreed that phosphorus made them much more brittle. Many of the plates would undergo the tensile test quite satisfactorily, but would fail completely if knocked or subjected to extremes of temperature.

The INSPECTOR observed that the figures indicated considerable brittleness.

Witness said the figures showed exceedingly bad composition.

The INSPECTOR: Are you inclined to think that the fracture commenced at the bottom?

Witness: I am inclined to think so.

Because theroretically that is the weaker place?—Of all the tank, the bottom is the weakest.

Against static pressure?—Yes.

You say the bottom would be the weaker against any jar?—Oh, no; the top, if there was the jamming. In this case, the tank would tear from the top.

You have never known cases of jamming?—I have never known cases of absolute jamming in spiral holders. I have heard of cases in which an ordinary gasholder has jammed and the lift come down. Every standard holder coming down in this way would be badly injured, and spiral-guided holders would suffer much more.

Asked whether he had formed any opinion as to the cause of the accident and the sequence of events which occurred, witness said following the bursting the tank let out the water. This distorted the outer guide-carriages, which immediately jammed the outer lift. The inner lift then came down with a run, rocking as it did so, because, perhaps, the paths were not true, owing to the contortion of the outer lift. It looked as if the outer lift had jammed, and that this distorted the guide-carriages of the inner lift—that the inner lift was jumping coming down, and when jumping there was a hundred times more chance of sparking than if it had been swinging in true guides.

The INSPECTOR: Can you offer any explanation of the cause of the gas firing?

Witness: That is the only explanation I can offer. If that was the sequence of events—that the inner lift was running down and partially jamming—there was more chance of the rollers sparking than if they had been acting properly.

You think that sparking would have been quite sufficient—that the gas would have been sufficiently diluted?—Yes.

Replying to further questions, witness discounted the idea that the possible cause of the accident was, as had been suggested, a spark from property contiguous to the works. If it had occurred in this way, there would have been a tremendous explosion.

The INSPECTOR: You think the gas must have lit at the holder as soon as it reached the free air, and quietly burned away?

Witness: Yes.

Mr. Milbourne stated, I think, that the plates of the upper lift were all burnt?—Yes, that is natural. Whenever the inner lift came out of its seal, the gas would be escaping in a horizontal ring, and about 2 or 3 feet up from the bottom of the inner lift there might be some sparking. I think it is quite reasonable to suppose that is the case.

The INSPECTOR: I think I understood from Mr. Milbourne that the burning was not apparent from the bottom of the outer lift.

Mr. *Milbourne:* The inner lift was fired at the bottom, showing, as I think, conclusively that the holder had been alight there before entering the water.

Mr. *Gibb*, asked in what way he thought the weakness of the top of the tank would have conduced to the disaster, replied that he did not think it conduced to it directly. If his assumption was correct—that it began at the bottom—the remainder of the tank was more likely to rip open from the bottom to the top. It was possible the lower plates might have burst, and the top held good if strong enough.

The INSPECTOR: You do not think that there was any possibility of the fracture having commenced at the top, seeing that there was no abnormal wind?

Witness: If the outer lift jammed, then I should say certainly the tear would start from the top, more especially as there were overhanging carriages with considerable leverage.

That is assuming it jammed first?—Yes.

Supposing the jamming was not the first thing that occurred?—Then it came from the bottom.

You think, as a matter of fact, that this did occur?—Yes, I think so. There are so many direct things to guide me towards that conclusion. There is the fact of the weakness; there is the fact of the fracture of the other side of the tank, which is difficult to account for in any other way; then there is the fact that the holder itself is little damaged.

Would you expect that, in the event of it jamming, it would have been much more damaged, and that it would have gone first?—With such a narrow factor of safety as the tank had, I should not like to say that would have happened in this instance.

In the event of a jam, would you expect it to crumple up more than it did?—I have seen ten or twelve ordinary holders that have come down, some with steel tanks. None of them has particularly distorted the tank. The holders have in every case been absolutely wrecked and crumpled up, like a brown-paper bag.

In the event of the tank bursting first in this case, I suppose the sides would have been burst apart, the rollers and carriages would have been violently wrenched free of the guides, and the holder would have been free to settle down with the water?—The outer lift was almost sure to be locked; but the inner one would probably be free to move down as far as it possibly could.

It seems to me more probable that the lower lift, jumping and swaying as it came down, carried the upper lift with it?—It all depends upon what did happen. When the tank burst, it must have locked the outer lift completely; but whether the locked carriages tore away quickly enough to do what is suggested, or whether the outer lift held the inner one sufficiently long to enable the other one to come down, I could not say. There is one thing I should like to add. The Company I am associated with now have upon their list the name of the firm who made this particular holder. It is a firm which has a very high reputation; and nothing which I have seen of this holder tempts me to strike the firm off our list of reliable people. I think there has been a tendency in recent years to cut down the weights of holders.

In answer to further questions, witness said he thought that most engineers were right to get designs from contractors. It was a special job. Every engineer ought, however, to be able to specify to the contractors that he should have a certain margin of safety, to specify the material he wished to be employed, and his general conditions. The designs, when submitted, could then be checked by an independent engineer, to make sure that the sections conformed with the specific margin of safety.

The INSPECTOR: He ought to specify the limit of working stress?

Witness agreed, adding that the minimum factor of safety should be 4. When the designs came along, it would, in his view, be better to employ some person to go into the stresses of the gasholder, and say whether the contractors had carried out the designs according to the instructions given them. As long as people would write for designs and prices for holders, and as long as contractors knew that the lowest prices would be accepted, there would be considerable temptation to cut prices, and there might be a danger to safety involved. He thought they had just reached the limit in the matter, and that they ought to go in the opposite direction.

The INSPECTOR: You think the working stress ought to be 6½ tons?

Witness: Not more than that. There ought to be a considerable difference in the margin of safety where you have a tank above or below ground. For tanks above ground, there ought to be a more generous factor than has been employed. In the case of one tank with which I have had to deal on my own works, the factor of safety is 8—a plain tank subject to no exceptional stresses whatever, but which contains creosote oil and where the factor is higher on account of the great necessity for sound rivetting and caulking.

In the case of a tank in which certain of the stresses are somewhat difficult to calculate, you would be inclined, I presume, to give a somewhat higher margin than 4?—Undoubtedly.

You would require a higher margin of safety in the case of a tank for a spiral-guided holder than for a frame-guided one?—Yes; it requires different construction, because the strain of the spiral holder must necessarily be taken by the top of the tank. Not only is a larger margin of safety desirable, but a differently designed tank altogether. For instance, you must provide for jamming stresses which it is impossible to estimate. It really means that you ought to calculate for the whole weight of the holder coming on to a few carriages, in view of possible impact. The practice which prevails in regard to standard holders is to carry the standards right to the ground, so that the standard and foundations take off all the wind stresses, and the tank is only a water-tank.

In the case of a spiral-guided holder, it is somewhat difficult to calculate what stress might be thrown on the rim of the steel tank?—That is why I advocate a more generous factor of safety.

You must have provision made for jamming stresses which it is impossible to estimate?—Yes. You ought to allow for the whole weight of the floating portion of the holder being thrown on five or six carriages and the adjacent tank. Spiral-guided holders have worked quite smoothly in the past. At Newcastle, the factor of safety allowed was four times the heaviest wind pressure experienced during the last 25 years.

Mr. WAUGH: If it were a fact that the guides of the outer lift were not distorted, would this affect the theory you have formed?

Witness: Yes; I should say that it probably jammed.

A stone thrown from outside the works might cause a jamming of the holder?—Yes, there are lots of ways in which it might jam.

If a stone were thrown over from an adjoining street, and, being of sufficient size, lodged between the rollers, that might cause a jam?—Quite possibly.

If the plates of the holder were distorted by fire not at the bottom but at the top of the crown, would not that also affect your theory?—No.

The other would?—Yes.

Mr. WAUGH: I am in a position to prove that the guides on the outer lift were not distorted. I understand the rollers were broken and the spindles bent, and this being so, I adhere to my theory.

Mr. MILWARD: I think that we all agree that if there was a jamming of the guides the tear would be from the top?

Witness: Yes, I think so; but I do not know whether we all agree upon the matter.

A witness this morning said he saw water spouting out from the top. That would show damage from the top?—I was rather anxious to clear up that point, as it was not made quite distinct.

The INSPECTOR: I asked him whether he could see what was occurring at the bottom of the tank, and he said he could not.

Mr. MILWARD: If that was right, it would decide the question that there must have been a tear on the top?

Witness: With regard to that, I was much impressed by the witness Hallam. He gave a clear account of the sequence of events. I think there is a witness to-day who said he saw the water coming from the bottom of the tank.

Mr. WAUGH: No.

By Mr. MILWARD: I suppose engineers, taking into consideration the bottom curb, could find a higher factor of safety than that.

Witness: The critical thing is that of the strength of the structure at its weakest point.

Assuming that the weakest point is just 2 inches above the bottom, it would be static pressure?—Yes.

The strain would not be greater one day than another?—The power to resist would be greater one day than another.

If you are right, can you explain why this tank should have lasted for three years?—It is a common occurrence for a structure to stand greater strains than those in operation when the collapse comes.

The strain would be the same the whole time, and would not be above the elasticity of the plates?—It might have been above the elastic limit but not above the breaking strength.

How much do you allow for elasticity?—Fifty per cent.

I suppose the stress has never been above that?—If you strain any material up to, or slightly above, the elasticity limit, it may go on for years and years; but it will never be the same metal. It will go sooner or later. With the evidence of brittleness in this case, the tank might go at any time.

Is it not correct to say that the presence of phosphorus, and the possible brittleness of metal, can only be affected by a blow?—Yes, or by alteration of temperature. If you put under test a bar of iron containing a large amount of phosphorus, you can get a curve of resistance to fracture according to temperature—extreme temperature, I agree. It is a well-known scientific fact that the actual figure you get from a tensile test can be affected by differences in temperature.

These temperatures, I take it, are purely artificial, as compared with the ordinary temperatures of the day?—Probably.

In practice, I suggest to you that the presence of phosphorus can only affect a plate in ordinary daily temperature if struck by a blow?—Not altogether. I grant it is the main point.

The INSPECTOR: Its brittleness is exposed under a blow?

Witness: Yes, even by a stone from the street, it may be. In regard to steel mains under water pressure, you may go along with tests for days, and they will be all right; but at another time a tap from a ¼ lb. hammer will cause a pipe to burst.

Mr. MILWARD: Does phosphorus affect more at a high or low temperature?

Witness replied that phosphorus affected the strength as the temperature went lower. It would tend, in this case, to cause the bursting at a lower temperature. He considered, however, that the presence of phosphorus was quite a side-element in this matter, and he did not attach any importance whatever to it in regard to the cause of the accident.

The INSPECTOR, in closing the inquiry, said he thought all necessary evidence had now been adduced to lead him to form a conclusion upon which to base his report. He proposed to visit another gas-works where these holders were in use. He recognized that he could not very well call manufacturers to give evidence in cases of this sort. They would naturally be reluctant to state anything against their competitors. He expressed his thanks to all who had assisted him in making the investigation.

DONCASTER PUBLIC LIGHTING.

High-Power Gas-Lamps Preferred to Electricity.

At the Meeting of the Doncaster Town Council last Thursday, there was an interesting discussion on the subject of the public lighting of the main thoroughfares of the borough. As already announced in the "JOURNAL," the result of experiments carried out by the Gas and Electricity Engineers (Messrs. Robert Watson and E. S. Rayner) was to lead the Lighting Committee to decide on recommending the Council to adopt gas; and their decision came up for approval.

Mr. STIRLING, the Chairman of the Electricity Committee, sought to upset the Lighting Committee's recommendation, and moved, as an amendment to the motion for its adoption, that it be referred back. He said when the question was considered, many of the members of the Council were absent. It was conclusively proved, on the tests made by the two engineers, that both the minimum and average illumination afforded by electricity between daylight and 11 p.m. was much higher than that given by gas, while the cost was the same as for the latter system of lighting. The profit to the Electricity Department would be £3 15s. against 12s. 6d. in the case of gas. The only point on which gas showed an advantage over electric arc lighting was in the illumination given after 11.30 p.m., which was slightly higher with gas.

Mr. RAITHBY seconded the amendment. He called attention to the loss of mantles and the blowing-out of the light—points which he said were unfavourable to gas.

Alderman ARMITAGE, the Chairman of the Gas Committee, opposed the amendment, as the matter had, he said, already been well thrashed out. The division between the Committee and the Council was narrowed-down to efficiency and cost. He pointed out that other towns had abandoned electricity for gas for public lighting, as shown recently in the case of Bournemouth [see *ante*, p. 135], where there was said to be a saving of £652 on the latter as compared with the former system. He maintained that, not only was gas cheaper than electricity, but, what was still more important, it was more constant. They could not depend upon the electric light.

Mr. DOWSON said it was a great pity these two Corporation departments had been put into competition, as it had only engendered ill-feeling. He was in favour of apportioning some part of the lighting to the Electricity Department, because the Gas Department was already overtaxed. How could they recommend the electric light to business men after saying they could not trust it themselves.

Mr. JACKSON thought it would be very unwise to interfere with the profit-earning capacity of the Gas Department. Granted that electricity was as cheap as gas, they already had the gas installed. The only reason for changing would be that electricity was so much cheaper than gas.

After some further remarks, the amendment was defeated by 13 votes to 8; and the recommendation of the Lighting Committee was then adopted.

Points in Favour of Gas for Street Lighting.

In view of this decision, it may not be without interest to give the following summary of the claims made by the Gas Committee for gas for the public lighting of the borough.

1.—Lower annual cost on the basis of both distributed and minimum illumination received on the street surface.
2.—Effective distribution of light, tending to evenness of illumination and avoidance of the sharp contrasts of relatively light and dark places; and this obtained by the use of comparatively smaller, but more closely spaced, units of light.
3.—Steadiness and certainty of the illumination due to the units being made up of more than one burner, and to each lamp being independent of the others.
4.—Penetration of the light during fog and mist, in consequence of the large aggregate lighting surface of the three mantles in use, and of the colour of the light.
5.—Utilization of existing columns and services, and therefore no expenditure on new material (other than the lamps themselves) or for re-spacing the columns, said to be necessary in the case of the Electricity Department's standards.

TWICKENHAM PUBLIC LIGHTING.

Urban District Council Recommend Gas.

The Lighting Committee of the Twickenham Urban District Council have lately considered tenders submitted to them by the Brentford Gas Company and the Twickenham and Teddington Electric Supply Company, Limited, for lighting the streets. The first-named Company quoted prices for the supply of gas only (maintenance, &c., being undertaken by the Council) for the whole or a portion, not being less than 200, of the public lamps for periods of one, three, or five years; also for the entire provision of gas, lighting, cleaning, &c., of the whole of the lamps for a period of not less than five years. The prices quoted by the Electric Supply Company, Limited, were for the supply of current to, and the renewal of metallic filament lamps in the street-lamps, about 500 in number, in the roads where the Company's mains are at present laid, or for any smaller number, not being less than 200, for periods of one, three, or five years. The Company also offered to undertake the necessary work in connection with converting the existing lamps for electric lighting, and for an additional sum to fix a time-switch to each post to enable the lamps to be switched on and off automatically at a given time. Details of both tenders are given in a report submitted by the Committee.

For the purpose of comparing the tenders, the Committee thought it would probably be sufficient to take a gas-burner consuming 4·2 cubic feet per hour, and approximately 80-candle power, and a metallic filament lamp of, approximately, 100-candle power. For the supply of gas for burners of the description named, the quotation of the Gas Company, based on a contract for one or three years, was £1 11s. 2d. per lamp per annum; and the present average cost of maintenance, &c., which is done by the Council, is £1 3s. 6d.—giving a total cost of £2 14s. 8d. per lamp per annum. If the price for gas were based on the terms submitted, for a five-years contract, the total cost per lamp per annum would be reduced to £2 12s. 2d. The price quoted by the Company for undertaking the whole of the work, including the provision of gas, lighting, cleaning, extinguishing, and maintenance, for similar lamps for a contract of five years was £2 14s. 8d. The quotation of the Electric Supply Company for the supply of current and renewals, for a lamp of approximately 100-candle power, based on a contract for five years, was £2 5s. per lamp per annum, and the Surveyor's estimate of the cost of lighting, cleaning, and repairs was 15s. per lamp per annum—making a total of £3. To this amount it would be necessary to add the cost of the work in connection with the conversion of the existing fittings, which, spread over a term of five years, would amount to approximately, 12s. 6d., or a total of £3 12s. 6d. per lamp per annum. As an alternative, if the lamps were fitted with time-switches, and the total capital cost spread over a term of ten years, the Surveyor estimated that the cost would be reduced to £3 per lamp per annum. The Committee recommended the acceptance of the tender of the Gas Company for the supply of gas only to the whole of the street-lamps in the district for a period of one year.

WIGAN CORPORATION GAS UNDERTAKING.

The Past Year's Working.

The report of the Gas Engineer to the Wigan Corporation, Mr. F. Betley (who, as already announced in the "JOURNAL," has succeeded the late Mr. Joseph Timmins in the position), embracing the twelve months ended March 31 last, has been issued; and it furnishes the following particulars in regard to the working of the undertaking.

Beginning with the manufacture of gas, it is stated that there was a considerable quantity of carburetted water gas made, owing largely to the prolonged strike in the coal trade, which served as an opportunity for demonstrating the extreme utility of plant for making this kind of gas in case of emergency. A portion of the plant is to be duplicated. The total quantity of gas made and sold showed an increase, partly due to the greater use of gas for cooking purposes during the very hot summer of last year. There was an addition of 619 to the number of the consumers—practically the whole of them on the prepayment system; and there were 148 more cookers supplied. The quantity of coal carbonized was 35,316 tons 14 cwt., and 180,052 gallons of gas oil were used; the total make of gas being 486,985,000 cubic feet—an increase of 13,961,000 cubic feet, or 2·95 per cent., on the preceding year. The bulk of gas sent out was 456,473,900 cubic feet; being 13,961,500 cubic feet, or 3·15 per cent., more than before. Of the total, 81,963,300 cubic feet were consumed through prepayment meters; being 10,366,200 cubic feet, or 14·47 per cent., more than in the year 1910-11. It is satisfactory to find that no coin-boxes were broken into during the year. The residual products were: Coke and breeze, 565,764 cwt.; tar, 464,117 gallons; ammoniacal liquor, 1,383,200 gallons; and sulphate of ammonia, 1,040,224 lbs.—being at the respective ratio per ton of coal carbonized of 15·35 cwt., 13·14 gallons, 39·16 gallons, and 29·45 lbs.

The financial particulars in regard to the undertaking show that the gross profit was £29,322, and the net profit £5290; and the public lighting, which is free, is put down for £5509. The two last-named amounts produce £10,799 as the actual net profit for the year, compared with £10,086 before. The cost of coal and its equivalent was 11s. 2d. per ton, and the revenue from residuals was 10s. 10½d.; so that the net cost of raw material was 3½d. per ton. The capital invested in the undertaking is £234,994; being at the rate of £5 3s. 8d. per ton of coal carbonized, 9s. 8d. per 1000 cubic feet of gas made, and 10s. 4d. per 1000 cubic feet sold.

Mr. Betley's report is accompanied by an abstract of the accounts of the undertaking prepared by the Borough Treasurer (Mr. G. Dickson).

Coke-Oven Gas for Middlesbrough.—The Gas Committee of the Middlesbrough Corporation have recommended the Town Council to accept the offer of Sir B. Samuelson and Co., Limited, for a supply of coke-oven gas, provided it can be obtained on advantageous terms.

MOSSLEY CORPORATION GAS UNDERTAKING.

A Record in Sales for the Past Year.

In his annual report, Mr. James Taylor, the Gas Engineer and Manager of the Mossley Corporation, is in a position to record very successful working of the department for the past financial year. The gross revenue amounted to £23,109, and the gross expenditure to £17,827; leaving a profit of £5282. After payments to the sinking fund and for interest on loans, there is a net profit of £1005, out of which £700 has been transferred to the borough fund, against £640 last year. The receipts for residuals were much higher than in former years; and the yield per ton of coal carbonized showed a marked increase upon previous results up to the end of February. The inferior coal that had to be used during the miners' strike gave very low yields of residuals, and thus reduced to a considerable extent the total results for the year. Largely owing to the abolition of fixing charges for gas appliances sold by the Gas Department, the past year was most successful as regarded the sale of gas. The increase in the sales amounted to 10,386,500 cubic feet—an amount which has never been approached in the history of the undertaking. Mr. Taylor believes there is still considerable scope for developing business in this direction.

The total number of meters fixed at the end of the year was 7506, compared with 7231 at the close of 1910-11; the prepayment meters numbering 2200. The total quantity of gas sold through prepayment meters was 22,751,700 cubic feet, against 19,201,900 cubic feet in the preceding twelve months. The bulk of coal carbonized during the year was 12,860 tons, compared with 11,615 tons in 1911; and the gas made was 150,322,100 cubic feet and 136,307,600 cubic feet respectively—an increase of 10·28 per cent. last year. The total quantity of gas delivered was 150,027,100 cubic feet, against 136,770,700 cubic feet in the previous year; and the total sold was 134,838,400 cubic feet, against 124,451,900 cubic feet for the year 1910-11. The gas unaccounted for was 10·12 per cent.; and the quantity sold per ton of coal carbonized was 10,485 cubic feet.

Mr. Taylor states that the cost of extra supplies of coal obtained during the strike was exceedingly heavy. Fortunately, however, the period of the dispute was divided between two financial years; and thus the department was better able to bear the unexpected heavy charges incurred. He adds that sanction has been obtained from the Local Government Board for borrowing £28,200 for gas-works purposes, and that considerable extensions of mains and other plant will consequently be effected this year.

WIDNES GAS-WORKS EXTENSIONS.

A £30,000 Scheme Sanctioned.

The Widnes Town Council had under consideration last Tuesday the question of the extension of the gas-works at a cost of £30,000. The Gas and Water Engineer (Mr. Isaac Carr) had reported that the capacity of the proposed plant was 2,500,000 cubic feet per diem, as compared with 2,200,000 cubic feet, which was the capacity of the existing carbonizing plant. The new plant, however, would be laid down so as to lend itself easily to an extension up to 3½ or 4 million cubic feet; and storage would be provided for 9000 tons of coal. The advantage arising from the introduction of more modern plant would be that the cost of manufacturing gas, which had for a number of years been less than in any other gas-works, would be still further reduced, and would mean a total saving of £8000 yearly. Mr. Carr asked for instructions to proceed with the scheme, and advised that the existing surplus profits should be used in defraying the cost of carrying it out.

Alderman TIMMIS, the Chairman of the Gas and Water Committee, moved the adoption of their minutes, embodying the request of the Engineer in regard to the gas-works extension scheme, and a resolution that he be instructed to proceed with the collection of all necessary information for the preparation of a detailed scheme for submission to the Committee.

Mr. BEACHAM moved an amendment to the effect that the extension of the gas-works be deferred for six months, on the ground that he was not satisfied that it was an opportune time to take such a step. He said that in 1905 there had been a decrease of 2 million cubic feet in the quantity of gas manufactured; and with the introduction of electricity into the borough, he was not at all satisfied as to its effect upon the consumption of gas.

Alderman G. I. NEIL seconded the amendment, and remarked that there could be no harm in postponing the matter for six months. A strong company had not taken on the responsibility of supplying electricity to the public unless they had good grounds for believing that it would be a profitable concern. When, as was contemplated, all the shopkeepers were supplied with electricity, it was quite possible there would not be the same quantity of gas required.

Mr. G. DAVIES remarked that if Mr. Beacham would pursue his inquiries further, he would find that the increase in the amount of gas sold between 1894 and 1911 was about 250 per cent.; and there was therefore absolute necessity for some provision to be made for the extension of the works.

Mr. CLARKE said the present gas-works were reconstructed in 1895, and since that time gas manufacture had made very great strides indeed. Even if electricity was the menace which Mr. Beacham thought it was, it would be absolutely necessary for the Council to set about improving their gas-making plant to keep pace with the increased competition. He would never consent to any scheme until it had been thoroughly digested in Committee.

Alderman TIMMIS, replying to the points raised, said the experience of all towns throughout the country had been that the gas and electricity undertakings increased their production together. There had been a revolution in gas making since the Widnes works were last reconstructed; and it was believed that with more modern plant and methods great economies would be effected which would more than pay for the expenditure incurred. Mr. Carr estimated that the amount saved would be not less than £8000 per annum; and he did not think

that in the thirty years Mr. Carr had been at Widnes anyone could say that his statements had not turned out accurately. There was no intention on the part of the Committee to proceed with anything until the scheme had been thoroughly discussed by the Council.

On the amendment being put, only the mover and seconder voted for it; and it was accordingly declared lost.

The minutes also contained a resolution to the effect that the terms provisionally arranged by the Engineer with the United Alkali Company for the surrender by them of the lease of land in their occupation required for the extension of the gas-works should be approved.

Alderman NEIL moved an amendment that no further steps should be taken in regard to the surrender of the lease until the express sanction of the Council had been received. He said that they were told that vertical retorts were taking the place of the old type, and that they occupied less room. Therefore, it was a matter for consideration whether the additional land would be needed. If they built all the new works on the new land, there would be a great deal of the older portion of the works lying unoccupied.

Some discussion ensued; but in the result the amendment was declared lost by one vote. The minutes were then approved.

MANCHESTER GAS COMMITTEE AND COAL SUPPLIES.

Restricted Purchases for the Current Year.

With ample stocks in hand, and having regard to the increased quotations as compared with last year, the Gas Committee of the Manchester Corporation have decided upon a restricted purchase of coal required at the gas-works for the current year. A special meeting of the Committee was held last Wednesday to consider tenders received, and at the conclusion of the proceedings the Chairman (Mr. W. Kay) made a statement to the effect that it had been decided to purchase only 160,000 tons of coal for the requirements of the department. Not for twenty years, he said, had the Committee bought so small a quantity; and they had been able to do this chiefly on account of the foresight of his predecessor in the chair (the late Alderman Gibson) and the members of the Committee, in buying beyond their actual requirements year by year. With the new purchases, the department would have sufficient coal for its needs during the next sixteen months; and in the present state of the coal market, a great saving would be effected in the working of the undertaking on the manufacturing side, seeing that the annual consumption of coal at the several stations totalled about 410,000 tons. According to the annual report of the Gas Committee, published in the "JOURNAL" for the 18th ult. (p. 911), the quantity of coal carbonized, including the equivalents of oil, for the twelve months ended March 31 last was 496,918 tons, compared with 498,707 tons in the preceding year.

NATIONAL ELECTRIC CONSTRUCTION BILL.

This Bill was ordered to be reported for third reading by the Unopposed Bills Committee of the House of Commons last Wednesday. It will be remembered that the Bill has met with considerable opposition; its proposal being to legalize agreements with a large number of electricity supply authorities for so-called "free" wiring of premises for electric supply. Mr. Lees (Parliamentary Agent) said the circumstances under which the Bill became unopposed were well known to the Chairman of Ways and Means—a settlement having been come to with all the authorities concerned as the result of a suggestion made by him. It was to the effect that the wiring and fittings concerned in the agreements should be taken over by the various supply authorities at a valuation—a course which had been followed in every case with the exception of Coventry and Poplar. In these two instances, both authorities had acquired powers to carry out wiring and fitting, and were therefore in a position to confirm the agreements. It had been agreed to schedule to the Bill copies of each agreement where they differed; and in order not to have every agreement in the Bill, copies of each separate agreement had been filed, and would be signed by the Lord Chairman in the House of Lords, and the Chairman of Ways and Means in the House of Commons as if they were plans.

New Joint-Stock Companies.—The General Gas Securities and Trust Company, Limited, has been formed with a capital of £20,000, in £1 shares, with the object indicated in the title. The Alresford (Hants) Gas Company was registered as a limited company on the 5th inst., with a capital of £10,000, in £1 shares, £5000 of which are 5 per cent. cumulative preference shares. A Company has been registered with a capital of £30,000, in £1 shares, to enter into an agreement with Messrs. T. B. Townson and C. A. Mercer, and to take over the business of manufacturers of, and dealers in, chemical and scientific apparatus carried on at 34, Camomile Street, and 55, Bishopsgate, E.C., as Townson and Mercer.

Right of Entry to a Testing-Room.—An interesting point was raised at a recent meeting of the Brecon Town Council, on the report of a Committee appointed to ascertain whether or not the Council had the right to demand the key of the testing-room at the Brecon Gas Company's works. The Council, as one of the Company's largest consumers, claim the right of entry to the room in order that periodical inspections may be made by their Examiner, Mr. F. L. Stanton. The Committee had previously discussed the matter at great length in private; it being stated that a key of the room is not held by them at the present time. On the recommendation of the Committee, it was decided that a key should be procured for the use of the Examiner. The point at issue now is, Will the use of the key be legal, seeing that the relations between the Council and the Company are only such as exist between the latter and any other large consumer?

SOUTH METROPOLITAN COMPANY'S CO-PARTNERSHIP SCHEME.

An Explanation by Mr. Charles Carpenter.

The current number of the "Co-Partnership Journal" of the South Metropolitan Gas Company opens with the following article by the Chairman, Mr. Charles Carpenter, in which he gives some interesting particulars as to the working of the co-partnership scheme.

I was asked the other day whether our employees understood the principles upon which our co-partnership is based; and, in reply, I expressed my belief that the large majority of them certainly did, but that in our case we had, perhaps, exceptional means for familiarizing them with the subject. I had in mind not only the "Journal" which Mr. Layton so admirably edits, but our excellent Co-Partnership Committee, which, as is well known, consists of twenty-seven elected representatives of the workers, associated with an equal number of nominated officials, and which provides the means of keeping in touch with the many thousands of the Company's employees whose homes and work are scattered over the fifty odd square miles which form our territory for gas supply.

Very few of these would be likely to fall into the same blunder as did a writer in one of the newspapers some little time ago, who made much of the fact that, though we had a capital of about 8½ millions, we only (!) paid in bonus £40,000 a year. But in such a statement the fundamental principle of our co-partnership is lost sight of—viz., that the excess of earnings over and above our nominal profits cannot be shared or disposed of until those in our employ as workers have received fair wages, and those who hold our capital fair interest (in our case 4 per cent. per annum). Not until this arrangement has been carried into effect is the surplus shared by apportioning the surplus profits as a percentage addition upon the wages which the employees receive, and the money which the capitalist invests in the Company's business.

To make the story complete, the following figures must be added: For the year 1911, there was paid in dividends on stocks £351,500, and in wages and salaries to employees £655,169. The dividend is equal to 7⅔ per cent. upon the total of the money actually put into the business. The co-partnership bonus is 8¼ per cent. upon the wages actually paid, which may be fairly considered to represent the workers' capital in the undertaking. It cannot, therefore, be suggested that justice is rendered unequally in settling the respective remuneration of those who supply the brains and muscle and those who provide the capital.

However, one need not understand the principles of good government to appreciate the advantage of living under them; and it is certain that our employees are as much of accord in their preference for working under co-partnership conditions as are their employers. It is satisfactory to find how well this is exemplified by the progress made in the amount of capital our employees hold as shareholders; and it is confidently anticipated that the figure reached when the bonus just due is dealt with will be a holding of £338,000, having a money value, at present prices, of £402,000.

Shareholding is, of course, an indispensable feature of co-partnership. There can be no more practical manner of expressing one's interest in any industry than by taking shares in it; and we look to a continued extension in this direction among our employees of all ranks. From shareholding, too, in our case, results the election of Employee Directors; and there is no doubt whatever that among other advantages of such representation is that it affords a direct channel of communication between the Board of Management and those who are engaged in our business.

It is a great sweetness of toil when we know that by our labours we can make provision greater than our needs. It is said by some that labour is in itself wearisome, not by the physical fatigue resulting, but by the monotony of the vocation it is the lot in life of the average worker to be placed in. It may be so in some instances; but I am sure the vast majority of our men are happy in their work. Shakespeare says that "the labour we delight in physicks pain;" and whether our troubles are of the mind or of the body, it will help us to forget them if we endeavour by all means in our power to take a greater interest in our daily work.

Our bonus for the past twelve months remains, as before, at 8¼ per cent. on wages. It was hoped it would be more; but the coal strike and the severe losses it entailed to all classes alike put that out of the question for some time at least. But there are still improvements to be made in our working; and it is earnestly desired that in the coming year we shall make continued progress in the pursuit of our ideals, both as regards extended business and the happiness of those engaged therein.

MUNICIPAL TRADING PROFITS AND THEIR APPLICATION.

At the recent Annual General Meeting of the Incorporated Institute of Municipal Treasurers and Accountants at Cardiff, a paper on this subject was read by Bailie WALTER NELSON, the Chairman of the Gas Finance Committee of the Glasgow Corporation. The following are its principal features.

I think the view of all sagacious councillors, and certainly of the members of an institute like ours, will be that a full and fair accounting should always be made as between departments for services rendered or products sold. Granting that there may sometimes be difficulty in fixing a reasonable price, owing (say) to the large consumption of the product by the corporation as compared with other customers, all that should be conceded, if there is to be a true accounting, is "the most favoured nation terms." These can easily be calculated where there is a standard sliding-scale in (say) the cases of gas, electricity, and water.

But if there be no such scale, then the actual cost of production of the commodity may fairly be taken.

Assuming that the revenue account of the undertaking presents no difficulty in respect of the matters above mentioned, and that all ordinary expenditure has been paid or provided for, the balance is usually carried to a net revenue or profit and loss account. Against this balance are charged the rentals of leased property (if any), interest on loans, and provision for depreciation. Thereafter the surplus on the profit and loss account is carried to an appropriation account, which is debited with sinking-fund instalments; and if there be a surplus or deficit, it is carried to the rate account, or otherwise disposed of by the municipality in accordance with the powers given it by Statute.

Depreciation.

I am aware that difference of opinion exists as to the legality and propriety of debiting revenue with depreciation where a statutory sinking fund is in force. The subject has been fully discussed at previous meetings of the Institute; the views of the public have been expressed from time to time in the Press; and wordy war rages on the problem on the occasion of the presentation of the annual accounts of trading departments in many town councils.

The Departmental Committee on the Accounts of Local Authorities was evidently reluctant to give a lead on the question, and contented themselves with stating that "the repayment of debt, so far as it goes, may properly be regarded as provision for depreciation. But it is possible that the period allowed for repayment may be excessive; and therefore in some cases further provision for depreciation may be necessary."

The weight of professional expert opinion is in favour of a provision for depreciation. The wear and tear of fixed assets is essentially an element in the cost of the year's trading; and provision for this depreciation, including possible obsolescence, should not be determined or affected by the result of the trading. It should form a charge on the revenue account of each year before the balance of net profit is struck, and should not be treated as an appropriation of any balance of net profit available.

It appears to me that a fair rule on this thorny question is: In all cases, where practicable, the undertaking ought to be maintained from year to year in complete and efficient working order out of revenue. Where it is impracticable to secure full maintenance out of the year's trading, a depreciation fund should be provided to secure reinstatement. If this course be followed, consideration of the "life" of the subject in relation to the sinking fund becomes eliminated.

There are, of course, undertakings which do not call for depreciation. As an example, we have water-works, where the up-keep charges, apart from replacement of sections of mains, vary little from year to year. Moreover, the "life" of these mains may usually be taken as of equal duration with the period allowed for the repayment of the capital borrowed.

The case is different with gas-works, electricity works, and tramways. Here the "life" of much of the working plant, and in some instances of the buildings, falls far short of the periods given by Parliament wherein to pay off the capital debt. Moreover, the probability of obsolescence, in the case of many of the assets of such undertakings, must not be lost sight of.

While admitting that the circumstances of each undertaking must be fairly considered, and that it would be unreasonable to lay down a general standard or scale of depreciation, I may say that the city of which I am a representative has put into practice, after full inquiry, scales which, as regards the gas and electricity undertakings, may be worth giving here.

It may be added that the question of depreciation was fully discussed before the Committees of both Houses of Parliament when Glasgow was promoting a consolidation of its Gas Acts in the session of 1910, and that the scale for the gas-works buildings and plant, hereinafter mentioned, has obtained the express *imprimatur* of Parliament. The Consolidation Act was not an unopposed measure, and it is significant that Parliament took occasion to review the powers of utilizing profits from their gas undertaking then held by Glasgow. Under its main Gas Act of 1869, Glasgow had power to carry any balance of profits to the credit of the Corporation for their general purposes—in other words, they might apply these profits in aid of rates, if so minded. By the Act of 1910, this power was taken away, and the Corporation were expressly directed to apply profits to the reduction of the gas charges throughout the limits of supply.

Gas Undertaking.

	Per Cent. per Annum.
Gas-works	1½
Chemical-works	3
Pipes	2
Meters	6
Stoves	10

Electricity Undertaking.

	Per Cent. per Annum.
Land and buildings	1
Machinery and plant	3½
Accumulators	5
Mains and cables	2½
Meters	4

Two factors influence the "profits" or net surpluses from trading, assuming the balance of the trading account has not been inflated by reason of inadequate provision having been made for depreciation, or from want of attention to those items of charge or undercharge to which I have referred in an earlier part of this paper. These factors are the interest on the money borrowed on behalf of the undertaking, and the sums which require to be set aside for repayment of debt.

With regard to interest, municipalities have been able to borrow at considerably keener rates than ordinary commercial companies. The rates in recent times have ranged from 3 to 3½ per cent.; most of the larger municipalities having borrowed, on the average, at or slightly under 3¼ per cent. The outlook for the future is not so bright; and unless existing municipal enterprises are well and economically managed, and their plant kept up to a high state of efficiency, the public may not respond so readily as they have done in the past. When new loans fail to be marketed, the effect of any distrust on the part of the public will be reflected by a demand for higher rates of interest.

Periods of Repayment.

In fixing the period for repayment, Parliament usually endeavours to strike a happy medium whereby the interests of the present ratepayers or users, who naturally desire that the repayment should be as long as possible, and the interests of future ratepayers and users, which demand that the burden of an expensive loan shall be removed as early as possible, are harmonized.

Sixty years is about the maximum period allowed for the repayment of local loans, whatever the estimated "life" of the undertaking may be. This period appears a short one in the case (say) of water-works, especially where the water is conveyed for a great distance from the city or area served by the undertaking. Moreover, in the case of nearly every expensive undertaking of this character, provision has to be made considerably in excess of present needs; and these works do not usually become fully productive for a number of years after construction. It would appear more equitable in the case of water-works for Parliament either to postpone the operation of the sinking fund for a period of from five to ten years after date of completion of the whole works, or alternatively to extend the period for repayment to (say) eighty years. On the other hand, the periods allowed in the case of gas-works, electricity works, and tramways are, in the main, liberal.

Application of Profits.

It is admittedly difficult, if not, indeed, impossible, to generalize regarding the policy which should be followed by municipalities in making contributions to the rates out of the net surpluses of their trading departments. The circumstances of the locality in which the operations are being carried on, the fact of there being competitive industries in the district served by the undertaking, the extent to which the undertaking is supplying districts beyond the city proper, the risks attending the carrying on of the enterprise, are all factors which have to be taken into account.

While the policy followed in Scotland has mainly been towards appropriating surpluses in reduction of the price of the commodities or services, in England it is openly claimed that municipal undertakings have, in the main, been entered upon by the municipalities with the view to the application of the profits in aid of rates. There is no doubt that, at the inception of municipal trading, it was held out by the local authorities, when promoting Bills for the different classes of commercial or *quasi*-commercial undertakings, that the commodities or services would be capable of being supplied to users at cheaper quotations than were obtainable from existing trading concerns in private hands, and that a considerable margin would be available thereafter for the benefit of the ratepayers. There is diversity of opinion as to whether the promise first named has been made good. Generally speaking, the quotations of local authorities for their commodities show substantial reductions on former time prices, and closely approximate, and in some instances are under, the prices quoted by up-to-date competitive public companies.

Having regard, however, to the general experience of the past twenty years, and to the tendency nowadays towards increasingly large, and sometimes arbitrary, transfers to rate accounts, it is claimed that some limit should be put upon the allocation of "profits" towards rates. This claim, to my mind, is well founded; but it is by no means easy to indicate what the limit should be; and Parliament would appear to be too busily occupied with questions of Imperial finance to take up seriously the defining of a limit such as is desiderated.

A Few Suggestions.

From a careful examination of the accounts of trading departments of the principal municipalities in the kingdom, some helpful information is obtainable; and the suggestions which, as a result of that examination, I throw out for the consideration of this Institute are as follows:

1.—That, after having in view the interests both of users and ratepayers, a limitation on the sums which a municipality is entitled to treat as profits from its trading departments is desirable.

2.—That the fairest basis is to allow a definite percentage on the actual capital sums expended on the undertaking, which percentage should be chargeable (1) with the annual amount of interest due and paid in respect of the debt of the undertaking; (2) with the annual amount of sinking fund instalment due and paid or set aside in respect of the undertaking; (3) any surplus, after defraying the charges just named, to be treated as surplus profit available as the municipality may deem best, either in aid of rates or as a reserve fund, for the reduction of the price of the commodity or service, or in reduction of debt.

3.—That, having regard to the character of the undertakings hereafter named, and to the periods allowed them respectively wherein to pay off their debts, the percentage should not exceed the sums stated—viz: In the case of water-works, 5 per cent.; gas-works, 7 per cent.; electricity works, 7 per cent.; tramways, 7 per cent.

4.—That if the revenue account of the undertaking should show a surplus at credit after provision is made for the percentages just stated, such surplus should be applied towards depreciation, if depreciation has not already been charged to the year's trading; and if any sum thereafter remain over, such sum should be carried forward to the trading account of the succeeding year.

Fylde Water Board and the Insurance Act.—The Fylde Water Board have resolved that the wages of all permanent workmen in their employ shall be increased in accordance with a list submitted by the Finance Sub-Committee, the alterations to commence from yesterday—the date the National Insurance Act came into force. A return prepared by the Secretary to the Board shows that their contributions under the Act will amount to approximately £629 per annum, in addition to about £743 a year provided by the officials and workmen.

NEW WATER-WORKS FOR STOCKPORT.

Opening of the Kinder Works.

The official opening of the Kinder Water-Works, which have cost the Stockport Corporation upwards of half-a-million sterling, took place last Thursday in the presence of a large company. Alderman Albert Johnson, the Chairman of the Water Committee, first turned on the water from the new reservoir by opening the valve at the base of the embankment; and then the Mayor (Alderman A. Briggs) opened the mechanical filter installation.

In the course of his remarks, Alderman Johnson said that in the construction of these water-works they had met with great difficulties; but, in spite of this and the excessive expenditure incurred owing to the bad foundations and open beds of shale and rock met with in the valley, the works would be a very valuable asset to Stockport. It was not the fault of the Water Committee or of the Corporation that the difficulties referred to had arisen; and he might say the ratepayers, who had thrown upon them the responsibility of making good any deficiency in the income of the undertaking, were bearing the burden uncomplainingly. Dealing with statistics, Alderman Johnson pointed out that the population supplied with water by the Corporation totalled 171,000. The daily consumption last year was 4,200,000 gallons; and the income of the undertaking had risen from £41,000 in 1900 to £59,000 in the past financial year. The area supplied was about 80 square miles.

At the conclusion of the inaugural ceremony, the company had luncheon, at which the customary toasts were duly proposed and honoured.

The new reservoir has a capacity of 515 million gallons, and covers an area of about 44 acres. It is at the base of Kinder Scout; and the work of construction has been in progress since 1902. The embankment is nearly 1200 feet in length; and the height from the bed of the river to the top is about 116 feet. At the ground level, the maximum width is 590 feet; and the width at the top is 14 feet. Provision has been made for dealing ultimately with 5 million gallons of water a day. After being filtered, the water will pass into two tanks adjoining the south side of the filter-house, each having a capacity of 250,000 gallons. Messrs. George H. Hill and Sons have been the Engineers under the scheme, with Mr. Basil Mackenzie as Works Manager and Mr. A. M. Fairbairn as Resident Engineer.

Water Supply for Kingscliffe.—Mr. Leonard Brassey, M.P., has offered to supply Kingscliffe, in Northamptonshire, with 5000 gallons of water daily from his pumping-station and reservoir at Apethorpe, for a minimum annual rental of £72. The Council have thus been saved spending £2000 on a scheme of water supply.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

Edinburgh.

At a meeting of the Edinburgh Town Council on Tuesday, a motion was submitted by Councillors Harrison and Stark to the effect that communications should be commenced with the Edinburgh and Leith Corporations Gas Commissioners with the view of opening a portion of the old gas-works site in New Street as a recreation ground for the district.

Auchterderran.—At the third ordinary general meeting of the Cardenden Gas Company, Limited, on Tuesday, the balance-sheet presented showed that the profits for the year, including the balance carried forward and after placing £350 to a general reserve fund, amounted to £643, which it was agreed should be applied as follows: (1) In payment of 5 per cent. dividend, free of income-tax, on £8500 shares, £425; (2) in writing off a portion of the preliminary expenses, £40; and (3) in carrying forward (subject to Directors' fees) the balance, £178. It was agreed that the price of gas be reduced from 4s. 7d. to 4s. 4½d. per 1000 cubic feet. Mr. William Brown, Gas Manager, was appointed Secretary.

Brechin.—The annual report of the Brechin Gas Company, Limited, shows a profit for the year of £1874 7s., after deduction for depreciation. It is proposed to put £200 to the reserve fund, £1350 towards dividend (being at the rate of 18s. per share), and the balance to go forward subject to Directors' remuneration. The receipts for gas sold by ordinary meters amounted to £2731 11s. 10d.; prepayment meters, £2389 18s. 5d. Coke produced, £564 15s. 6d.; sulphate of ammonia, £265 6s. 3d.; and tar, £178 3s. 8d. The heaviest item of expenditure was coal—£2080 6s. 2d. Wages absorbed £1088 19s. 4d.; and taxes, insurance, &c., £484 1s. 6d. The amount carried to the profit and loss account amounted to £2234 16s. 8d. The price of gas is to remain as formerly.

Cupar.—Sheriff Honeyman presided on Thursday at the annual meeting of the Cupar Gas Company. The report of the Directors showed the amount of credit was £1215, which, together with last year's balance of £119, gave a total of £1334.

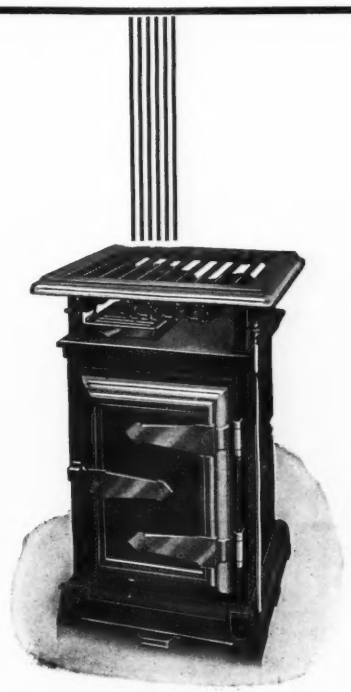
Dunfermline.—At the monthly meeting of the Town Council held on Monday, an estimate of the revenue and expenditure for the year from May 16, 1912, to May 15, 1913, was submitted. This estimate showed a credit balance of £66 4s. 3d. The Committee resolved that the prices for gas to consumers within the city and within the Limekilns area be fixed at the same figures as last year. The Convener of the Gas Committee said that in the coming year the 17,000 tons of coal which they would require would cost something like £2700 more than their contract price for last year. While, however, they were paying this extra sum for coal, their increase for residuals was £1300.

"Main" Merits.

Familiarity with the "Main" Cookers begets confidence in their merits. They represent the highest attained degree of workmanship and quality.

They appeal to the practical man because of their efficiency, the simplicity of their design, and the accessibility and strength of wearing parts.

While making more and more new friends every season, they retain their hold on the affections of old friends.



R. & A. MAIN, LIMITED,

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 13, Whitworth Street West, MANCHESTER; 8, Exchange Place, Donegall Street, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

The coal contracts agreed upon were as follows: Messrs. D. A. Penman and Co., Glasgow, 8000 tons of Lumphinnans coking double nuts at 11s. 3d. per ton and 1500 tons of Lumphinnans coking single nuts at 10s. 7d., both delivered at the gas-works siding; the Lochgelly Iron and Coal Company, Limited, 5000 tons of Hartley smalls at 10s. per ton, delivered at the gas-works siding.

Hamilton.—At the monthly meeting of the Town Council on Tuesday, the Gas Committee submitted the balance-sheet for the year, which showed a net profit, omitting shillings and pence, of £1412, which, with the balance of £1266 carried forward from last year, made a total of £2678. The Committee agreed to recommend that £1250 be transferred to the revenue of the common good, and that the balance of £1428 be carried forward. It was agreed to recommend that the price of gas be continued as it is at present. The report was adopted.

Inverkeithing.—Anticipating a greatly increased consumption of gas, the Gaslight Company are adding to their plant and storage. The large new holder, which was constructed less than two years ago, is already inadequate for the demand made upon it, and workmen are at present engaged adding an additional lift, which will almost double its holding capacity.

Kelty.—The annual report of the Kelty Gas Company for the year ending May 31, has just been issued. The total sales amounted to £4511, and the expenditure was £3527; leaving a balance of £983 to be carried to the net revenue account. It is proposed to allow £500 for depreciation, and to pay a dividend of 6 per cent. on the Company's share capital.

Kinross.—The annual report and balance-sheet of the Kinross and Milnathort Gaslight Company, Limited, has just been issued. The results of the year's trading show a net profit of £489. The Directors recommend that a dividend of 7½ per cent., free of income-tax, be paid. The consumption of gas has increased by over 865,000 cubic feet, and the larger sale of coke has added materially to the profits.

Lochgelly.—The annual meeting of the Lochgelly Gas Company, Limited, was held on Friday. The report showed that 35 million cubic feet of gas had been manufactured. The sum at the credit of profit and loss account was £1786; and a dividend at the rate of 7½ per cent. was declared.

Markinch.—It was reported at the annual meeting of the Markinch Gas Company that there was an increase of 10 per cent. in the consumption of gas last year, which was a record. It was agreed to pay a dividend of 6½ per cent.

Stranraer.—The Gas Company have decided to increase the price of gas by 2d. per 1000 cubic feet.

Stirling.—The shareholders of the Stirling Gaslight Company held their annual meeting on Tuesday. The report showed an increase in the number of consumers, in the amount of gas manufactured, and in the profits earned. The consumers number 6970—an increase of 103 on last year. The total profits earned, after paying all expenses, amounted to £7538, which, after allowing for the usual dividends, left a balance of £2854 to be carried forward. There are 2826 slot meters, an increase of 133 on last year; and the revenue obtained from them was £5742—an increase of £370 on the previous figures.

Tayport.—At the monthly meeting of the Town Council on Monday, the price of gas was fixed at 3s. 4d. per 1000 cubic feet—a reduction of 2½d.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 13.

Sulphate of Ammonia.

Throughout the week, the market for this article has still continued on its downward course, and manufacturers have only found it possible to dispose of their present stocks by accepting a further reduction in prices. The direct inquiry has again become rather poor, and the present curtailed production has evidently been sufficient to satisfy the dealers' requirements. The closing quotations are £14 2s. 6d. per ton f.o.b. Hull, £14 3s 9d. per ton f.o.b. Liverpool, and £14 5s. per ton f.o.b. Leith. In the forward position, little actual business has transpired, but it is reported that the equivalent of £14 7s. 6d. per ton f.o.b. Liverpool has been accepted by makers for delivery late this and early next year, and that there are second-hand sellers for July-December shipment at £14 5s. per ton.

Nitrate of Soda.

The market for this material remains quiet but steady, and holders on spot maintain quotations at 11s. per cwt. for ordinary and 11s. 1½d. for refined quality.

LONDON, *July* 15.

Tar Products.

The markets for tar products continue firm. Pitch maintains its price; but business is still difficult to negotiate. Consumers are unwilling to pay the prices being asked at present. Benzols are firm; and further business is reported in the 90 per cent. quality for near and forward delivery. Solvent and heavy naphthas maintain their prices; and the inquiries for near and forward are very regular. Crude carbolic is without alteration; but it is difficult to arrange new contracts. Creosote is firm.

The average values during the week were: Tar, 28s. to 32s. *ex* works. Pitch, London, 53s. to 53s. 6d.; east coast, 52s. 6d. to 53s.; west coast, Clyde 53s. to 54s. 6d., Manchester 51s to 52s., Liverpool 52s. to 52s. 6d. Benzol, 90 per cent., naked, London, 11⅛d. to 1s.; North, 11⅛d. to 11⅛d.; 50-90 per cent., naked, London, 10d.; North, 9½d. Toluol, naked, London, 10½d. to 11d.; North, 10d. Crude naphtha, in bulk, London, 5d. to 5⅛d.; North, 4⅛d. to 5d. Solvent naphtha, naked, London, 1s. 1½d. to 1s. 2d. f.o.b.; North, 1s. to 1s. 1⅛d. f.o.b. Heavy naphtha, naked, London, 11d. to 1s. f.o.b.; North, 10d. to 10½d. f.o.b. Creosote, in bulk, London, 3d. to 3⅛d.; North, salty, 2⅝d. to 2⅞d.; liquid, 2⅝d. to 3⅛d. Heavy oils, in bulk, 3⅛d. to 3⅜d. Carbolic acid, casks included, 60 per cent., east and west coast, 2s. 6d. to 2s. 7d. Naphthalene, £4 10s. to £10; salts, 45s. to 50s., bags

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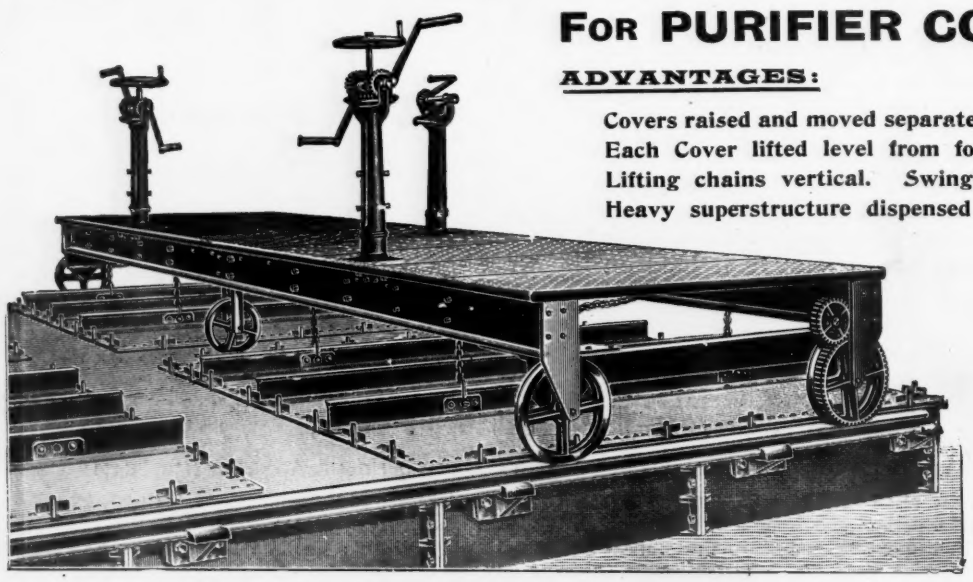

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Sulphate of Ammonia.

There has been very little movement in this article during the past week, though there has been a fair amount of inquiry for the forward position. Actual Beckton is quoted at £14; outside London makes, at £13 7s. 6d. to £13 10s.; Hull, £14 5s.; Leith, £14 6s. 3d. to £14 7s. 6d.; Liverpool, £14 5s.; Middlesbrough, £14 5s.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a stronger demand for coal; and with a normal output, the shipments are heavy. In the steam coal trade, best Northumbrians are from 13s. 3d. to 13s. 9d. per ton f.o.b.; second-class steams are 11s. 6d.; and steam smalls from 8s. to 9s. In the gas coal trade, the production is full, and the demand is fair for this season of the year. Best Durham gas coals are now quiet at 13s. per ton f.o.b., and second-class from 11s. 6d. For "Wear specials," up to 14s. per ton f.o.b. is quoted. A number of contracts for gas coal have been settled; and others are in course of negotiation. The South Shields gas coal supply has been decided on. The price is said to be from 11s. 3d. to 11s. 6d. per ton, according to the quality; but these figures are not official. Another lot has been sold for delivery over next year at about 12s. 4½d. per ton f.o.b. for best, and 11s. 6d. for second-class; while some cargoes of "specials" have been sold at relative values. There is now more disposition to buy forward; and it is expected that some of the largest of the home contracts will soon be in the market. Coke is firm. Good gas coke is quoted at about 18s. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

With the approach of the several trades' holidays throughout Scotland, the demand for various kinds of coal during the week was brisk, and prices were well maintained. On the Glasgow Coal Exchange on Friday, the f.o.b. prices quoted were: Steam coal, 11s. 6d. to 11s. 9d.; splints, 12s. to 12s. 6d.; ell, 11s. 6d. to 11s. 9d.; trebles, 12s. 3d. to 12s. 6d.; doubles, 12s. to 12s. 3d.; and singles, 11s. 6d. to 11s. 9d. From the Lothians and Fife coal-fields, the export trade is strong at slightly enhanced prices.

Last Tuesday, Messrs. William Bush and Sons sold £15,000 of 4 per cent. debenture stock of the Sheffield United Gas Company at from £105 to £106 10s. per £100 of stock.

The Torquay Town Council have appointed Mr. R. V. Toms to the post of first Assistant Water Engineer in the place of Mr. J. H. Hutchinson, who had been selected as the Water Engineer to the Paignton Council.

Accrington Gas and Water Board.—The Accrington Gas and Water Board, at their last monthly meeting, received the report of a Special Sub-Committee who were appointed to inquire into the installation of a system of mechanical crushers, overhead conveyors, and mechanical stoking plant for the gas-works at Great Harwood, and approved the recommendations. A resolution to make application to the Local Government Board for powers to borrow £11,000 was passed. By this scheme, the Board hope to effect a saving of some £2000 a year in the manufacture of gas.

Kingskerswell Lighting.—It has been decided by a public meeting to reopen negotiations with the Torquay Corporation for the supply of gas for private lighting at Kingskerswell. Some time ago, the Corporation offered to lay mains to the village and supply gas at 3s. 9d. per 1000 cubic feet, or 9d. in excess of the amount charged at St. Mary Church, in which the gas-works of the Corporation are situated. The offer was then rejected because of the fear that lighting the village streets with gas would be too heavy a burden on the rates. The ratepayers still oppose the adoption of the Lighting and Watching Act.

Diesel Engine Explosion at an Electricity Works.—The electricity works of the Bray Urban District Council were last Wednesday the scene of a shocking accident, which resulted in the death of a fitter named Coates, and fearful injury to Mr. Souter, the Electrical Engineer. Mr. M'Donald, the Assistant-Engineer, also received serious injuries to his head and face. In an interview, Mr. John Traynor, the Chairman of the Electricity Committee, said the disaster arose from the bursting of one of the cylinders of a 50-H.P. Diesel engine. At the inquest, the Town Clerk (Mr. P. M'Donnell) said the engine was erected about 2½ years ago, and he never heard any serious complaint about the working. The Coroner said he did not think professional evidence with regard to the engine was necessary. Of course, there would be a Board of Trade inquiry. The Jury found that the deceased died from shock following injuries resulting from the explosion, and expressed their sympathy with the wife and family.

Chelmsford Water Supply.—The Chelmsford Rural District Council, at their meeting last Tuesday, received a letter from the Local Government Board with reference to their application for sanction to borrow £1400 for the purchase of land adjoining the water-works at Great Baddow, and the construction of a covered reservoir, and enclosing extracts from a report of the Board's Geological Surveyor, which concluded by intimating that the supply was liable to contamination, and a safer site should be acquired farther south. A written report was read from Dr. J. C. Thresh, Essex County Medical Officer of Health, who stated, as the result of his twenty-two years' experience, that the spring water was not polluted; that, when analyzed, it always showed the highest degree of purity; that it had never been contaminated; that there was no better spring supply in Essex; and that it had even improved since the Council had obtained control over the adjoining field. It was decided to send Dr. Thresh's letter to the Local Government Board.

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TEST THE CALEFACTOR.

31A

More Glover-West Vertical Retorts for Manchester.

The Manchester Corporation Gas Committee, at a meeting held last Thursday, accepted a tender from West's Gas Improvement Company, Limited, for an installation of Glover-West vertical retorts at the Rochdale Road station. During the past year, the horizontal retorts in the "C" retort-house at this station were worked out, and the plant has been dismantled for the installation of vertical retorts. The carbonizing capacity of the house with horizontal retorts was 2 million cubic feet per day, and this will be increased to 4 millions with the verticals. The installation of Glover-West retorts at the Droylsden station has been found to work satisfactorily. The Chief Gas Engineer (Mr. J. G. Newbigging, M.Inst.C.E.), reporting upon the installation to the Gas Committee last month said: "The vertical retorts continue to work satisfactorily, and though the plant is only of a nominal capacity of 500,000 cubic feet per day, the gross cost of manufacturing the gas closely approximates to the best results which can be obtained at any of the larger stations."

Lincoln's New Water Supply.

The completion of the Lincoln new water supply scheme was marked last Wednesday, when the Mayor (Mr. J. Mills) turned on the valve of the Bracebridge Heath reservoir; and the city has now secured, at a cost of some £235,000, ample provision in the matter of water at Elkesley Moors. An inspection of the Elkesley works was followed by luncheon; and during the afternoon the service reservoir was thrown open to the public—the inside being illuminated by hundreds of Chinese lanterns and fairy lamps. The councillors having paid a visit underground, the company were addressed by Mr. N. M'K. Barron, the Water Engineer, who explained that the reservoir had cost £27,000, and would hold 6 million gallons, or 3½ days' supply for Lincoln. It is circular, with a reinforced concrete roof. Special provision is made for circulation in the reservoir; the water being introduced at eight points round the circumference, and also at the centre, and withdrawn from one point at the side. There is no ironwork to which the water can have access; and the reservoir is covered with 13 inches of soil, so that the water may remain at the same temperature as when it leaves the bore. A dividing wall enables one part of the reservoir to be cleaned out while water is being supplied from the other. Mr. Livens, the Chairman of the Water Committee, congratulated the citizens on the consummation of the great scheme; and the Mayor, after turning on the valve of the reservoir, was presented with a suitably inscribed miniature valve-key, in silver, by Mr. Walker, of the firm of Messrs. Underwood Bros., the Contractors, who said Lincoln was singularly fortunate in having an Engineer like Mr. Barron.

The Rothesay Town Council have decided to instruct the Gas Manager (Mr. W. Whyte) to prepare specifications for a new gasholder with a capacity of 300,000 cubic feet.

An Interesting Problem in Bird Life.

The current issue of the "Co-Partnership Journal" of the South Metropolitan Gas Company contains an article by the Chief Engineer (Mr. W. Doig Gibb) under the above heading. It is accompanied by two illustrations—one being an ordinary lamp-post in the Bromley Road, and the other showing four birds' nests, each containing two eggs; and Mr. Gibb gives an interesting explanation of the connection of the two pictures. It appears that, some little time ago, one of the Company's foremen, noticing that the enamelled reflector of the lamp was cracked and dull, and not up to the usual standard, ordered its removal and replacement. The lamplighter's astonishment can well be imagined when he found in the upper side of the reflector the nests shown. Fortunately he was a man of sense, and carefully took his find to Old Kent Road. Mr. Gibb says: "The nests and eggs are those of either the Cole titmouse or the blue titmouse—two varieties of the family of titmice, some six in all. It is probable that blue tits are responsible for the extraordinary production. Every lover of bird-life knows these sprightly little creatures, ever in motion, performing acrobatic movements in their search for insects and grubs, and always bright and cheerful. The gardens of South London know them well in winter; but in spring they move off to quieter places for breeding purposes. They are pugnacious little creatures; and in the breeding season it means 'war to the knife' if two pairs set up their breeding quarters too close to each other. . . . Blue tits do not often build a second or a third nest without apparent cause. The four nests shown may therefore be the work of one pair of birds. . . . If one pair be responsible for all, the building and rebuilding may have been the desire to find cooler quarters than could have been afforded by an incandescent light burning below the nursery every night. The nesting in semi-darkness (as the top of a lamp would be) is not singular, since the common nesting-place is generally a hole in a wall or in an old tree. . . . Be the solution of the present problem what it may, it is a distinct and most interesting case, and one which even the experience of Charles Stonham, Esq., the best authority on British birds, has never before come across. Whether town environment has changed the habits of the birds, whether it is the first case of polygamy among the species, whether the great warmth tended towards an unnatural result, or whether eight pugnacious little birds found the air so pure above a South Metropolitan burner, and became so endowed with the spirit of co-partnership as to be induced to share the room provided by the same kind Company, must be left to the readers' imaginations."

Oldham Corporation Water Supply.—At last Wednesday's meeting of the Oldham Corporation Water Committee, the General Manager (Mr. A. Andrew) stated that the net profit on the working of the undertaking for the past financial year was £9743, which was the largest profit made in any one year since the Corporation acquired the water undertaking. The capital expenditure, he added, was now practically at a standstill; while interest and redemption charges were very small.

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Three Records at Southport.

In moving the adoption of the Gas Committee's minutes at last Tuesday's meeting of the Southport Town Council, Alderman Trounson said that in respect to the past year's working they had broken three records—first, in the amount of gas sold; secondly, in the amount of profit realized; and, thirdly, that there had been no expenditure on capital account during the year. At the beginning of the year, the Gas Committee said they would, if possible, give £13,000 towards the relief of the rates, as they had done before. They also had in their mind the possibility of paying £4000 toward the reconstruction of the plant. This had been realized, and in addition they had a surplus profit amounting to £5447. This did not represent the whole profit of the Gas Committee. By not putting anything to capital account last year, they were able to reduce the standing charges per 1000 cubic feet of gas. Referring to the annual report which was noticed in last week's "JOURNAL" (p. 134), he said the Committee had expressed their satisfaction to the Gas Engineer (Mr. John Bond) at the work he had done during the twelve months, and he wished to take this opportunity of voicing it publicly. There was no estate connected with the Corporation in which the men and the officials worked more loyally to support their chief.

The revenue of the Seville Water-Works Company for the year ended the 31st of March was £40,895. After deducting working expenses, the cost of laying on services, &c., the net profits were £9502; while £4249 was brought forward. A dividend of 3½ per cent., free of income-tax, is proposed; carrying forward £4218.

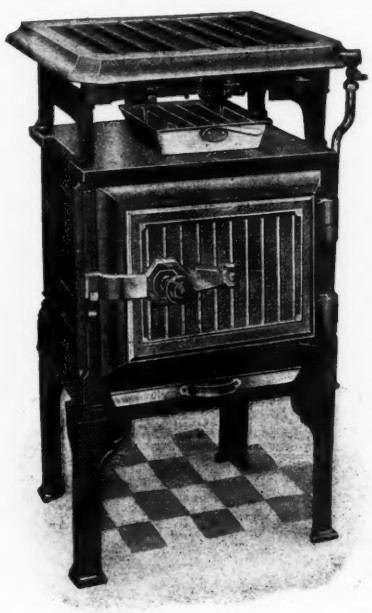
By the breakdown of one of the engines at the electricity works last Thursday evening, the whole of Southport was for some time placed in darkness, so far as the electric light was concerned. The failure, which occurred just after nine o'clock, gave rise to several humorous incidents. At the Temperance Institute, where a meeting was being held to consider the National Insurance Act, question time had been reached when the light went out. Gas-jets were lighted, and the business was proceeded with.

A profitable conference was organized and recently carried out by the Davis Gas-Stove Company at their Luton works. The occasion was the travellers' summer conference, and the usual proceedings were considerably added to. On the 4th inst., an interesting and instructive lecture on "Gas-Fire Construction" was given to the assembled sales staff by the Chief of the Technical Department. The whole of the following day was occupied by conference business; and on the Saturday there was a cricket match arranged between a team captained by Mr. Cyril G. Davis and a rival team drawn from the Luton works. From comments which were heard on all sides during the three conference days, one would be inclined to think that similar proceedings are likely to be repeated on subsequent occasions.

APPLICATIONS FOR LETTERS PATENT.

15,302.—SMITH, H. C., "Gas-burners." July 1.
15,353.—GRAEFE, P., "Drying gases." July 1.
15,356.—BORRI, I., "Piping systems." July 1.
15,360.—HUME, G. W., "Meters." July 1.
15,379.—BLAKE, L. J. B., "Gas-turbines." July 1.
15,381.—STRACHAN, R. P., and STRACHAN AND HENSHAW, LTD., "Telphers and tracks." July 1.
15,384.—ARNDT, M., "Measuring gases." July 1.
15,392.—BROWN, W., "Secondary water-tap." July 2.
15,428.—PORTIELJE, G., and JAS, J. C. A., "Gas-compressor." July 2.
15,467.—DEZENDORF, R. L., "Meters." July 2.
15,470.—DUCKHAM, A. M'D., "Gas-valve." July 2.
15,515.—DEMPSEY, W., "Apparatus of the rotary type for charging retorts." July 3.
15,549.—PARKINSON STOVE COMPANY, LTD., and MAWBEY, P. C., "Gas-fires." July 3.
15,584.—C. OTTO AND CO., G. M. B. H., "Recovering tar and ammonia." July 3.
15,585.—HUMPHREY, H. A., and RUSDELL, W. J., "Raising or forcing liquids." July 3.
15,645.—SEARSE, C. E., "Taps." July 4.
15,660.—SIEMENS BROS. DYNAMO WORKS, LTD., and CALLOW, S. H., "Photometers." July 4.
15,665.—MERRICK, S. C., "Gas-lamps." July 4.
15,669.—COX, F. J., "Air-gas plants." July 4.
15,671.—FENLON, H. T., "Gas-cocks." July 4.
15,677.—PHILIP, A., and STEELE, L. J., "Detectors of combustible gases." July 4.
15,688.—REYNOLDS, A., "Regenerative furnaces of the Siemens reversible type." July 4.
15,725.—POTTER, J. H., "Cocks." July 5.
15,742.—BURKHEISER, K., "Process for producing ammonia from sulpho-cyanide compounds, and for the purification of compounds containing sulpho-cyanide compounds." July 5.
15,745.—WELSBACH LIGHT COMPANY, LTD., and RULER, W., "Incandescent burners." July 5.
15,765.—RENTSCHLER, A., "Gas-stoves." July 5.
15,770.—UNGAR, W., and GABRYEL, J., "Gas-turbines." July 5.
15,777.—ILLINGWORTH, S. R., and the GAS LIGHTING IMPROVEMENT COMPANY, LTD., "Process for the removal and recovery of carbon bisulphide." July 5.
15,785.—OLSEN, S., "Generating air gas." July 5.
15,787.—DOSCH, A., "Determining the specific gravity of gases." July 5.
15,851.—VENNER TIME SWITCHES, LTD., and GRIESBACH, R. C., "Time-controlled valves." July 6.

"JUST THE COOKER"



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to meet the small consumers' demands where, for various reasons, the use of an ordinary cooker is impossible.

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COMPACT AND CONVENIENT.

SUPPLIED WITH OR WITHOUT STAND.

Largely adopted in conjunction with Slot Meters.

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BIRMINGHAM & LONDON.

GAS COMPANIES' STOCK AND SHARE LIST.

The condition of things on the Stock Exchange continues going from bad to worse. It is not possible within the limits of this article, even if it were desirable, to discuss the causes. Some impute the blame to certain factors, and some to others; but all agree that the state of affairs is worse than they can remember. Noting a week ago a price of 75 1/16 for Consols, it was observed that this might not long remain a record. It was beaten three times last week. On Monday, Consols touched 75 7/16; on Friday, 75 3/8; and on Saturday, 75 5/16. The evil effect of this depressed other markets already burdened with their own troubles. The opening day was dismal enough. Markets were semi-inanimate and gloomy; Consols dropped 3/8. Railways were weaker, and Americans fell. On Tuesday, the tendency was equally weak. Gilt-edged made no recovery, Railways were lower where they moved at all, and Americans continued to fall. Wednesday was a shade better, as Railways were steadied by a little professional buying, and Americans turned the corner. Thursday maintained a fair tone mostly; the settlement giving rise to no apprehensions. Americans were, however, very flat. Friday went back altogether, and depression was rampant. Gilt-edged things were very dull; and Railways made lower prices, owing in some measure to realizations. Consols fell 1/4. On Saturday, there was a very sparse attendance by reason of the great heat and outdoor attractions. All markets were heavy and dull. Consols closed at 75 1/4 to 75 1/2—a fall of 3/8 in the week. In the Money Market, there was a good demand, and rates for short loans and discount were firm. Business in the Gas Market was quieter, sympathizing to some extent with the abatement of activity conspicuous in other departments. Owing also to similar sympathetic influences, perhaps, prices were for the most part not quite up to the level to which the market is accustomed. In Gaslight and Coke issues, the ordinary was but moderately dealt in; and the figures at which transactions were marked were fractionally easier—103 to 103 5/8; being a fall of 1/4. The secured issues also underwent a slight reduction. The maximum was done at 84 1/2 to 85 3/4 (a fall of 1), the preference at 100 and 100 1/2 (a fall of 1 1/2), and the debenture at 75 and 76—a fall of 2. South Metropolitan was quiet and rather easier, realizing from 118 1/8 to 119—a fall of 1. Only one bargain was marked in Commercials—the 4 per cent. changing hands at 109 3/4. Among the Suburban and Provincial group, Brentford old was done at 261 and 262, British at 45 1/2, Brighton original at 216, Ilford debenture at 91 3/4, South Suburban at 122 1/4 and 122 1/2, and Wandsworth at 141. On the local Exchanges, Liverpool "A" marked 219 and 220, ditto "B" 159, and Sheffield "C" 234. In the Continental companies, Imperial realized from 182 to 184 1/2 (a fall of 1 1/2), ditto debenture 89 3/4, Malta 4 7/8, and Tuscan debenture 98 1/2. Among the undertakings of the remoter world, Hong Kong marked 16 5/8 and 16 7/8, Monte Video 11 1/4 and 11 9/16, Oriental 134 1/2, Primitiva from 7 1/8 to 7 1/4, ditto preference 5 1/8 to 5 1/4, San Paulo 14 (a rise of 2), and ditto preference 11 1/8.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Apl. 12	5	Alliance & Dublin Ord.	73—78	..	6 8 2
374,000	Stk.	July 12	4	Do. 4 p.c. Deb.	89—91*	..	4 7 11
250,000	5	Apl. 12	7 1/2	Bombay, Ltd.	6—6 1/2	..	5 15 5
50,000	10	Feb. 29	15	Bourne- mouth Gas and Water } 10 p.c.	28 1/2—29 1/2	..	5 1 8
332,000	10	"	7	B 7 p.c. Pref. 6 p.c.	16 1/2—16 3/4	..	4 3 7
75,000	10	"	6		14 1/4—14 3/4	..	4 1 4
380,000	Stk.	"	13	Brentford Consolidated	258—263	..	4 18 10
330,000	"	"	10	Do. New	196—201	..	4 19 6
50,000	"	"	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
206,250	"	June 14	4	Do. 4 p.c. Deb.	95—97	..	4 2 6
219,055	Stk.	Feb. 29	11	Brighton & Hove Orig.	215—220	..	5 0 0
244,200	"	"	8	Do. A Ord. Stk.	156—159	..	5 0 8
490,000	20	Mar. 28	12 1/2	British	44 1/2—45 1/2	..	5 9 11
120,000	Stk.	June 28	4	Do. 4 p.c. Deb. Stk.	91—93	..	4 6 0
109,000	"	Feb. 15	6	Bromley, A 5 p.c.	128—133	..	4 10 3
165,700	"	"	4 1/2	Do. B 3 1/2 p.c.	98—101	..	4 9 1
82,278	"	"	5 1/2	Do. C 5 p.c.	117—120	..	4 11 8
55,000	"	June 28	3 1/2	Do. 3 1/2 p.c. Deb.	78—80	..	4 7 6
250,000	Stk.	"	4	Buenos Ayres 4 p.c. Deb.	93—95	..	4 4 3
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—
100,000	10	—	—	Do. 4 1/2 p.c. Pref.	3 1/4—4 1/4	-1/2	—
100,000	Stk.	June 28	4 1/2	Do. 4 1/2 p.c. Deb. Stk.	74—78	..	5 15 5
157,150	Stk.	Feb. 15	5	Chester 5 p.c. Ord.	110—112	..	4 9 3
1,513,280	Stk.	Feb. 29	5/9/4	Commercial 4 p.c. Stk.	108—110	..	4 19 4
560,000	"	"	5 1/2	Do. 3 1/2 p.c. do.	103—105	..	5 1 6
475,000	"	June 14	3	Do. 3 p.c. Deb. Stk.	73—75	..	4 0 0
800,000	Stk.	May 31	4	Continental Union, Ltd.	83—86	..	4 13 0
200,000	"	"	7	Do. 7 p.c. Pref.	133—135	..	5 3 8
492,370	Stk.	—	5 1/2	Derby Con. Stk.	123—124	..	4 8 9
55,000	"	—	4	Do. Deb. Stk.	104—105	..	3 16 2
840,150	10	Jan. 31	10	European, Ltd.	19 1/4—20 1/4	..	4 17 7
16,160,600	Stk.	Feb. 15	4/14/8	Gas- light and Coke } 4 p.c. Ord.	102 1/2—103 1/2	-1/4	4 11 3
2,600,000	"	"	3 1/2	3 1/2 p.c. max.	84—86	-1	4 1 5
4,062,235	"	"	4	4 p.c. Con. Pref.	98—101	-1 1/4	3 19 3
4,531,705	"	June 14	3	3 p.c. Con. Deb.	74—76	-2	3 18 11
258,740	Stk.	Mar. 14	5	Hastings & St. L. 3 1/2 p.c.	93—95	..	5 5 3
82,500	"	"	6 1/2	Do. do. 5 p.c.	—	..	—
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	16 1/4—17	..	6 9 5
131,000	Stk.	Mar. 14	7 1/2	Ilford A and C	155—158	..	4 14 11
65,780	"	"	6	Do. B	123—125	..	4 16 0
65,500	"	June 28	4	Do. 4 p.c. Deb.	91—93	..	4 6 0
4,940,060	Stk.	May 15	9	Imperial Continental	181—186	-1 1/2	4 16 9
1,235,000	Stk.	Feb. 15	3 1/2	Do. 3 1/2 p.c. Deb. Red.	88—90	..	3 17 9

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
200,242	Stk.	Mar. 14	6	Lea Bridge Ord. 5 p.c.	125—129	..	4 13 0
561,000	Stk.	Feb. 29	10	Liverpool United A.	219 1/2—221 1/2	..	4 10 3
718,100	"	"	7	Do. B.	158—160	..	4 7 6
306,083	"	June 28	4	Do. Deb. Stk.	98—100	..	4 0 0
75,000	5	June 14	6	Malta & Mediterranean	4 1/8—4 3/8	..	6 3 1
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	—	..	—
250,000	100	"	4 1/2	Melbourne 4 1/2 p.c. Deb.	101—103	..	4 7 5
541,920	20	May 31	3 1/2	Monte Video, Ltd.	11 1/2—11 3/4	-1/4	5 19 2
1,775,892	Stk.	Feb. 15	4 1/2	Newc'tle&G'tesh'd Con.	100—102	..	4 5 9
529,705	Stk.	June 28	3 1/2	Do. 3 1/2 p.c. Deb.	85—85 1/2	..	4 1 10
55,940	10	Feb. 29	7/7/0	North Middlesex 7 p.c.	14—15	..	4 18 0
300,000	Stk.	May 15	8	Oriental, Ltd.	134—136	..	5 17 8
60,000	5	Mar. 14	8	Ottoman, Ltd.	7—7 1/2	..	5 6 8
31,800	53	Feb. 29	13	Portsea Island A	—	..	—
60,000	50	"	13	Do. B	130—133	..	4 17 9
100,000	50	"	12	Do. C	127—130	..	4 12 4
398,490	5	May 15	8	Primitiva Ord.	7 1/8—7 1/4	..	5 8 6
796,980	5	June 28	5	Do. 5 p.c. Pref.	5—5 1/4	+1/16	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
312,650	Stk.	June 28	4	River Plate 4 p.c. Deb.	93—95	..	4 4 3
275,000	5	Apl. 12	12	San Paulo, Ltd.	13 1/2—14 1/2	+2	4 2 9
150,000	10	"	6	Do. 6 p.c. Pref.	11 3/4—12 1/4	..	4 18 0
125,000	50	July 1	5	Do. 5 p.c. Deb.	49—51	..	4 18 0
135,000	Stk.	Mar. 14	10	Sheffield A	234—236	-1	4 4 9
209,984	"	"	10	Do. B	233—235	..	4 5 1
523,500	"	"	10	Do. C	233—235	..	4 5 1
90,000	10	May 31	7 1/2	South African	8—9	..	8 6 8
6,429,895	Stk.	Feb. 15	5/9/4	South Met., 4 p.c. Ord.	117—119	-1	4 11 9
1,895,445	"	July 12	3	Do. 3 p.c. Deb.	76 1/2—79 1/2*	..	3 15 6
209,820	Stk.	Feb. 29	8 1/2	South Shields Con. Stk.	157—159	..	5 6 11
605,000	Stk.	Feb. 15	5/16/8	S'th Suburb'n Ord. 5 p.c.	122—124	..	4 14 0
60,000	"	"	5	Do. 5 p.c. Pref.	117—120	..	4 3 4
117,058	"	July 12	5	Do. 5 p.c. Deb. Stk.	118—120*	+1/2	4 3 4
502,310	Stk.	May 15	5	Southampton Ord.	105—107	..	4 13 6
120,000	Stk.	Feb. 15	7 1/2	Tottenham A 5 p.c.	144—147	..	4 17 0
483,940	"	"	5 1/2	and B 3 1/2 p.c.	116 1/2—118 1/2	..	4 14 11
149,470	"	June 28	4	Edmonton 4 p.c. Deb.	94—96	..	4 3 4
182,380	10	June 15	5	Tuscan, Ltd.	8 1/8—8 3/8	..	5 15 11
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	97—99	..	5 1 0
236,476	Stk.	Feb. 29	5	Tynemouth, 5 p.c. max.	112—114	..	4 7 3
255,636	Stk.	"	6 7/8	Wands- B 3 1/2 p.c.	141—144	..	4 15 6
85,766	"	June 28	3	worth 3 p.c. Deb. Stk.	70—72*	..	4 8 4

Prices Marked * are "Ex Div."

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

COMMERCIAL SUPERINTENDENT. Glasgow Gas Department. Applications by July 22.
ASSISTANT LECTURER AND DEMONSTRATOR (COAL GAS AND FUEL). Leeds University.
ENGINEER REPRESENTATIVE. No. 5606.
REPRESENTATIVES. No. 5609
PUPIL-APPRENTICE. No. 5603.
CANVASSER, MAINTENANCE INSPECTOR, &c. Cowes Gas Department.
SERVICE LAYER. Redditch Gas Company.

Appointments, &c., Wanted.

OUT-DOOR DEPARTMENT. (No Salary) No. 5608.
SULPHATE PLANT MAKER AND REPAIRER. No. 5592.

Plant, &c. (Second-Hand), for Sale.

CONDENSERS. Walker and Wallsend Gas Company.
LAMP COLUMNS AND LANTERNS. Barnsley Gas Company.
STATION GOVERNOR, CENTRE VALVE, &c. Seaham Gas Company.

Patent Licences for Disposal, &c.

GAS GENERATING FURNACES. Young and Co., Southampton Buildings, W.C.
PURIFYING GAS.—METERS.—ACETYLENE GAS GENERATORS. Haseltine, Lake, and Co., 7 and 8, Southampton Buildings, Chancery Lane, W.C.

Correspondence Classes.

GAS ENGINEERING AND GAS SUPPLY. W. Cranfield, 11, Avondale Place, Halifax.

Stocks and Shares.

EXMOUTH GAS COMPANY. By Tender July 31.
SOUTHEND WATER COMPANY. London Mart. July 30.

TENDERS FOR

Coal and Cannel.

CONGLETON GAS DEPARTMENT. Tenders by July 20.
EXMOUTH GAS COMPANY. Tenders by July 26.
GUILDFORD GASLIGHT COMPANY. Tenders by July 18.
HAWORTH URBAN DISTRICT COUNCIL. Tenders by July 23.
HEREFORD GAS DEPARTMENT. Tenders by Aug. 10.
MALTON GAS COMPANY. Tenders by July 27.
MARKET HARBOROUGH GAS DEPARTMENT. Tenders by July 27.
MOSSLEY GAS DEPARTMENT. Tenders by July 18.
OLDHAM GAS DEPARTMENT. Tenders by Aug. 6.
ROCHESTER, &c., GAS COMPANY. Tenders by July 21.
SKIPTON URBAN DISTRICT COUNCIL. Tenders by July 25.

Gasholder (Re-Sheeting).

HOLYWOOD GAS COMPANY.

Gasholder and Tank (Concrete).

HUDDERSFIELD GAS DEPARTMENT. Tenders by July 31.

General Stores.

SALFORD GAS DEPARTMENT.

Purifying Material.

CANNOCK, &c., GAS COMPANY. Tenders by July 2

Roof (Iron).

G. LANE, Aylesbury.

Tar and Liquor.

HEREFORD GAS DEPARTMENT. Tenders by Aug. 10.
ROTHERHAM GAS DEPARTMENT. Tenders by July 23.

Valves, &c., for Gasholder Tank.

HUDDERSFIELD GAS DEPARTMENT. Tenders by July 31.